NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA

THESIS

DESIGN AND IMPLEMENTATION OF
THE INFORMATION TECHNOLOGY
MANAGEMENT GROUP FACULTY
RESEARCH CATALOG

by

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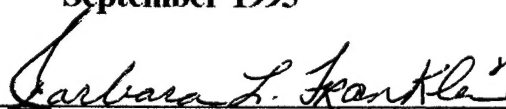of the requirements for the degree of

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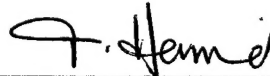
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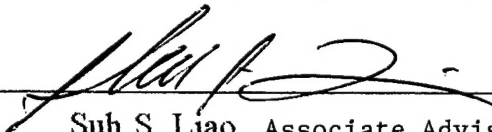
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ABSTRACT

This thesis analyzes the information requirements for a faculty research catalog for the Information Technology Group of the Systems Management Department at the Naval Postgraduate School to develop a modular designed document with a flexible file structure for implementation as a professional hard copy publication and as an electronic brochure on the Worldwide Web. This application provides the initial groundwork for future enhancements of the electronic brochure and a framework for the development of Faculty Research Catalogs for other Curricula within the Systems Management Department.

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I. INTRODUCTION

This thesis designs, documents, and implements a Faculty Research Catalog for desktop publishing and the World Wide Web (WWW), for the Information Technology Management (ITM) Group of the Systems Management Department (SM) at the Navy Postgraduate School (NPS), Monterey, CA. Information was collected during a preliminary investigation of the ITM group's requirements for a consolidated and attractive reference of the group's information. The information obtained and problems identified during the investigation that led to the conduct of the thesis are presented and the scope of the project are defined. Alternatives, methodology, and feasibility are discussed.

A. BACKGROUND

The ITM group consists of 15 faculty members. The ITM group's focus on applications of computer-based systems within DoD/DoN environments involves research with advanced technology, application of existing technologies, and the development of new technologies providing the potential for development of more efficient and effective information systems within the DoD/DoN context. The ITM group is a unique resource for providing assistance to DoD/DoN agencies through its well-recognized competence and wide range of interests.

In addition to research, prototype systems development, and executive education, the ITM Group has the additional task of soliciting sponsors for current and future research projects. The more sponsors available, the more research

opportunities available to the faculty and the more opportunities for student participation in real world problem solving.

In today's environment with continued cutbacks in government spending, sponsorship of research has become even more important. Fewer and fewer projects are funded by NPS. Funding for special equipment and associated student travel is scarce. Sponsors provide money for special research needs and make research opportunities available for both faculty and students not otherwise possible. Expanding contact with potential sponsors is critical.

B. PROBLEM DEFINITION

Interviews with a portion of the ITM group indicated that solicitation of sponsors is initiated through telephone contact, word-of-mouth, referrals, and previous contact. There was no formal publication available for mail distribution. There was no single point that consolidated information on the ITM group's focus, current research projects, and past research publications.

Two past attempts to consolidate the group's information into a group catalog were unsuccessful. The information available about these attempts was limited and documentation could not be found. One interview indicated that in the first attempt only one file was used for all of the information and that updates allowed access to all the material in the file. This single file design limits update of information to one user at a time and increases the risk of unintentional data alteration and/or destruction.

Another interview indicated that correcting errors and making changes are difficult with hard copy printing and that hard copy printing cannot be updated regularly. There was

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also a concern that maintaining multiple files for data separation, developing a flexible file structure, and interoperability between different word processing packages would not be achievable. Having the ability to edit individual text files with Word Perfect, Microsoft Word, or any word processor was required. Additionally, parts of the faculty information were dispersed in various publications such as the NPS Student Catalog, NPS Faculty Resume Catalog, and the Systems Management Faculty Information folder.

There were two primary obstacles facing the development of the catalog:

1. Overcoming the two disappointments of the past attempts. Each professor had to be assured that the catalog would be completed and printed. Each had to be assured that their input was vital to the success of the catalog.

2. Obtaining the required information for the brochure. Information for the catalog had to be provided by each professor in the ITM Group. There are 15 professors in the IT group. Each professor is constantly involved in research and continued professional development which require frequent travel, making face-to-face contact was difficult. Alternative methods of contact were: NPS guardmail, voicemail, and email.

C. SCOPE

This thesis is part of the SM departments effort to develop faculty research brochures for various disciplinary groups of the SM department for hard copy production and implementation on the WWW. Both vehicles will provide the desired consolidation of the ITM group's information and the

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required widespread dissemination.

The software system development life cycle (SDLC) will be used to develop both the hard copy and electronic form (to include: analysis, prototype design, final design, development, and implementation). Identical information will be contained both the hard copy and electronic document. Research issues are listed below:

- Identification of user requirements.

- Examination of existing publications which contain relevant information.

- Determine resources for required information.

- Determine which desktop publishing software package will provide flexible modular design capability.

- Examine procedures associated with implementing an electronic document on the WWW.

- Determine the most appropriate modular design for electronic implementation.

Deliverables:

- Information Technology Management Faculty Research Catalog in Hard copy form.

- Implementation of the catalog on the WWW.

- Software containing all files for future hard copy productions and WWW updates.

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D. METHODOLOGY

Prior to development of the ITM group faculty research catalog, a prototype document was developed based on initial interviews with select IT faculty members. Review of other educational institutions' faculty research publications was conducted to determine standard presentation formats for educational institutions. This information was combined to develop document information requirements and preliminary document format. Review of the prototype document by senior SM staff and select ITM faculty members will define user requirements.

Following this phase, a request for faculty information from all ITM group faculty members through e-mail, SM guardmail, telephone conversations, and personal interviews was conducted. The focus of this phase was to develop the modular design and finalize the type of information that was included. Information acquired from this request was used to refine user requirements.

A second iteration was developed incorporating refined user requirements and design changes. This prototype was distributed for review by the ITM group for accuracy and completeness. Changes from this phase was incorporated in the final document design. Laser printed copies or computer diskettes were compiled and forwarded for printing.

Coding of the electronic brochure will began upon completion of the hard copy document. Research of coding techniques, systems' interfaces and link requirements to the NPS home page for the WWW was conducted prior to implementation of the brochure in electronic form. The brochure was coded using HTML and following the appropriate WWW format.

Requirements for self-maintaining software development were researched and recommendations for future enhancements

have been included.

E.   FEASIBILITY

Feasibility of the project was determined by addressing the following four areas:

1.   Economic Feasibility

There were no requirements to purchase additional software or equipment for this project.   Software upgrades for the Ventura publisher are not necessary but generally cost around $300.   Ventura allows any available text editor to be used to update the text which reduces the need for special text editor upgrades.

Costs associated with the design, development, and WWW implementation of this document was limited to the personal time and effort of the author.

Printing costs over the lifetime of the document are expected to be minimal because the document can be printed by the government printing shop, the Defense Printing Service located on NPS or at the Defense Language Institute (DLI). Government printing allows printing costs to be charged to the general SM account or each individual professor's account. The printing facility at DLI has the ability to store the document on tape making successive printings simple.

If the document is maintained by successive graduate students as follow-on thesis projects, maintenance costs will be minimal.   However, if a faculty or staff member is assigned maintenance, maintenance costs will be incurred in direct proportion to the individuals salary and the amount of time required to maintain the document.

The extensive use of pull-down menus, simple easy-to-follow dialogue, and a comprehensive user's manual simplifies

training required to learn the Corel/Ventura Publishing software package and reduces or eliminates training costs.

2. Technical Feasibility

The technology necessary to conduct each phase of this project is available within the ITM group and the NPS main computer center. The hard copy design architecture allowed quick implementation on the WWW. A high degree of technical expertise is not required to interact with the system. Anyone having knowledge of the internet and the WWW will be able to easily access the electronic brochure.

Hard copy document updates will require:

- a desktop publishing package

- 386-IBM compatible computer with 8 RAM minimum

- Hard disk space necessary to accommodate the desktop publishing package

- 3 1/4" diskettes

3. Schedule Feasibility

Based on the findings of the preliminary investigation, the proposed system will be available as a complete working application and will include documentation by 15 September 1995. It should be possible to develop the hard copy document in four months and the electronic implementation in two months.

4. The Operational and Political Feasibility

The electronic implementation of the catalog will provide the department with the ability to update research information and publications regularly. This implementation allows access to anyone having Internet access. It provides a ready source of information to any potential sponsor and reduces waiting time for information. The modular design provides the potential sponsor with the option of viewing the entire brochure or specific pages.

The SM Department Chair and the ITM faculty members are supportive of this initiative.

II. REQUIREMENTS PHASE

This chapter discusses the requirements phase of the ITM Faculty Research Catalog's development. The purpose of this phase is to identify the specific data requirements to be contained in the brochure.

A. DATA REQUIREMENTS

Initially, interviews were conducted with the SM Department Chair, SM Department Associate Chair for Research, and two ITM Associate Professors. These interviews provided a general idea of the information requirements for the brochure. Seven primary categories of information were identified:

1. Input from the SM Department Chair
2. A general overview of the ITM group
3. Research in the ITM Group
4. The ITM research centers and laboratories
5. Faculty information
6. Research Sponsors
7. Faculty publications

This group was provided with samples of Research brochures from MIT, New York University, NPS Computer Science Department, and several other sources to select preliminary document formats.

A prototype document was constructed based on the information obtained from the initial interviews. The

prototype document was used to further refine user requirements. The resulting requirements are listed below:

- Letter from the SM Department Chair: This letter should briefly introduce the department, describe the department's curriculum composition, and provide a numerical estimate of faculty and staff. The remainder of the letter should focus on the ITM department: faculty capabilities, customer relations, etc. The Chair's photo and information through which to contact him should be included.

- Overview of the department: This section should discus the current world view of IT, highlight the importance of IT within DoD/DoN, and describe the ITM group's research efforts, prototype systems development and executive education program.

- Research in ITM: This section should focus on the ITM group's current research efforts. Each professor should provide a theme for his research, a brief 25 to 50 word description, a short paragraph describing the professor's work in this area, and related publications. Professors pursuing multiple research areas, should provide information for each area. Suggested research themes: Software Engineering and Project Management, Model Management, Database Management Systems, Computer Networks and Data Communications, Decision Support Systems.

- Research Centers: This section should provide a description of each center or laboratory, current research topics, and a point of contact.

- Research Sponsors: This section should identify recent sponsors for the ITM group.

- ITM Faculty: This section contains more detailed information for each professor, but is limited to one page of information. Each page should contain the professor's photo, name, title, and a phone number. Each professor should provide: research areas, descriptions of each research area, the relevance of the research to DoD/DoN, and recent publications. There should be no limitations on the length of input. The limitations should be placed on the printed form. Once the document is formatted, professors should have the opportunity to modify their input to satisfy page constraints.

- Publications: This section should list all publications and assign reference numbers to each publication. Publication descriptions should be as complete as possible.

B. REFINEMENT OF REQUIREMENTS

Requests for the desired information were made to each ITM professor. Each professor was provided a detailed description of what was desired and sample content format examples. Each ITM faculty member was contacted either in person or via telephone for clarification of the request. Feedback from the faculty was obtained via email, guardmail, or personal interview. Comments and suggestions were isolated and used to refine user requirements. The following changes were made:

- Faculty: The names of the ITM group were listed on one page with their degree, degree year, issuing institution and the year of joining NPS. This page was placed before the individual faculty pages. Email address, degree, degree year and issuing university were added to the individual faculty pages.

- Research Areas: Research categories were changed to: Model Management, Database Management Systems, Decision Support and Expert Systems, Software Engineering and Applications Development, and Networks and Communications. Specific research areas were placed under one of the broad categories. This change allowed each professor to more accurately describe his research.

- Publications: Publications were restricted to 1990-to present and categorized by year. The serial number assigned was composed of the letters 'IT', a two digit year designation, a decimal point, and a number from one to n (where n is the total number of publications in the specific year). For example, the first publication in 1995 would be: IT95.1

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III. THE VENTURA PUBLISHER

This chapter contains a description of desktop publishing
and functionality of the Ventura Publisher.   It discusses
Ventura's multiple file format, framed based documents,
modular components, and custom design information.

A. WHAT IS DESKTOP PUBLISHING

Desktop publishing (DTP) means assembling a finished
publication from several documents and/or graphics that are
usually developed in other, specialized applications using a
computer.   A more accurate term for DTP would be "computer-
assisted publishing." [Ref. 1]   The way it works is
documents are created with word processors (WP), drawings are
created using graphics packages, photos are scanned with
scanners, and other items are acquired using the appropriate
software package. The files acquired from the above sources
are imported into the DTP program where they are formatted.
The DTP puts all of the files into one publication. Indexes,
headers, footnotes, cross-references, and table of contents
are added as desired. A functional comparison between WP's,
graphics packages, and DTP's is contained in Table 1.

A DTP is not a do-it-all publishing solution. The secret
to using a DTP is knowing when to use it. When creating a
document, use a WP. WP's have much more powerful editing
capabilities and work better with text. Use a DTP when there
is a need to ensure consistent styling in complex documents,
precise typographic control in any length document, or
additional formatting features in a composite document.

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Word Processors	Graphics Software	DTP's
Create and manipulate text	Create and manipulate complex graphics	Strict typographic controls
Offer intuitive entry and quick processing of text	Manage text as a graphics element	Integration of elements from diverse sources
Provide text-oriented special features such as search, replace, spelling and grammar	Provide graphics-oriented special features such as color management and visual effects	Format-oriented special features such as powerful styles and automated formatting
Automatic text flow from a line, column, or page to the next.	Import and export a variety of graphics file formats	Precision control of text and graphics placement
Integrate with other office applications such as email	Integrate with Paint and image - Manipulation programs	On-screen layout and formatting of text and graphics
		Consistent, repeatable styles and layout in long structured documents
		Features for managing long documents such as tables of contents, indexes, cross-references, pagination, and flexible numbering

Table 1.   Functional comparison of WP's, graphics packages, and DTP'S.

B.   VENTURA

The Ventura Publisher was chosen for the project primarily because of the need for modular design capabilities. Ventura allows each page of a document to be constructed as a composition of files which enhances modular document design. An example of this feature is the Faculty chapter.   Each professor page contains an external graphic file, an external text file, and an internal file for page specific formatting. Modular design allows all information added to a document to remain in its original file with the original filename. Retaining separate files allows update of information by each

originator and provides greater protection of the entire document from accidental loss or destruction by allowing access to only the segment of the document that is being updated. This feature also increases data integrity when more than one individual is involved in data maintenance. Many desktop publishers do not include features that lend to modular design. In these DTPs the files that make up the document are merged into one file. For example, 20 files would become one file that included all of the formatting and all of the text. However, 20 files in a Ventura document remain 20 separate files and all of the formatting is also placed in separate files.

A second feature that Ventura offers is the ability to work in either a word processor or in the publisher for document update. This portability allows files to be updated by anyone having access to a word processor. Ventura's modular design and portability capabilities made it the ideal choice for developing the ITM Group's Faculty Research Catalog.

Another factor influencing the selection of the Ventura Publisher was its availability within the SM Department. SM maintains one copy of the Ventura Publisher in the ITM Multimedia Center and one copy with the SM Multimedia Specialist.

Internal and external files are mentioned frequently in this section. In each case, an internal file references the chapter file (.CHP) and contains instructions associated with that chapter. An external file contains either a graphic or the text for that page or chapter. A more detailed explanation of internal and external files is contained in Chapter III.

Ventura uses as system of file pointers and directory structures to keep track of files and file placement within a document. Unlike a word processor, it does not bring all of

the parts of a document together in the same file. It keeps track of each piece of a chapter by tracking the source and adding its own formatting codes to the original text files. These are external files as they are created outside the publisher. Separate files are used to store paragraph formatting information and text elements created inside Ventura. These files are internal to the publisher. The Ventura Publisher is based on three concepts: multiple-file format, frame-based documents, and modular components. [Ref. 1]

C. MULTIPLE FILE FORMAT

Most WP's and graphic programs work on the single-file format concept. Everything that is brought into a document or graphic becomes a part of a single file. Most other desktop publishers work under this principle. Text, graphics, and formatting information are integrated into a single publication file. Under this process, the source remains unchanged when the single publication is altered. When changes are made to the source, they must also be made to the single publication file.

Ventura is different as it allows for modular construction of documents by using a Multiple-file format (MFF) and pointers. A multiple-file format functions more like an organizer than an integrator. It organizes the separate elements in the page layout and keeps track of the files with pointers. When text files are edited within Ventura's MFF, the original source text files are actually edited. With the MFF you have the option of editing files within Ventura or within a WP.

Ventura keeps track of document assembly by creating a chapter (.CHP) file. The .CHP file contains all instructions

associated with a particular chapter. Full DOS path names are contained in the .CHP file. These path names are the pointers to the source files. One pointer in the .CHP file is used to identify the particular style (.STY) sheet associated with the chapter. Text files can be located in different directories and on different drives. A .CHP file contains:

- General layout and typography
- Chapter-level elements (headers and footers)
- A list of external text and graphics files
- Frame size, position, and formatting
- Location of frame contents
- One pointer to the chapter style sheet

Ventura tracks all chapters, .CHP files, by using a publication (.PUB) file. The .PUB file stores pointers to all chapters associated with a document and separate pointers to the table of contents and index files.

A publication manager (PM) is use to view and print a list of files for any chapter or chapters. The PM is also equipped with copy, move and delete functions for entire chapters.

D.   FRAME-BASED DOCUMENTS

Within Ventura, frames are used to store all file contents, both graphics and text. The publisher tracks the contents of each frame with references to internal or external, text or graphic files. The use of frames are required. Each element of a document must be placed in a frame. All frames can be formatted to the user's taste.

E. MODULAR COMPONENTS

This concept provides the user with the ability to mix and match document components as the user chooses. Changing style sheets, text, graphics in any chapter is easy. Ventura simply updates the pointers. Ventura allows all external graphics and text files to be shared between chapters by adding additional pointers. The same applies to style sheets, and other imported files. This feature makes Ventura extremely flexibility. [Ref. 2]

F. CUSTOM DESIGN INFORMATION

The style (.STY) sheet contains all of the custom design information associated with a document. It includes formatting information from internal and external files. Examples of formats that can be specified include the following:

- Type specifications: fonts, font size, colors, and style (bold, italic, or normal)
- Bullets and drop caps
- Overscoring, underling, and strikethroughs
- Ruling lines above, below, and around paragraphs
- Tab settings
- Hyphenation rules
- Horizontal and vertical alignment
- Text rotation
- Indents and outdents
- Spacing between lines, paragraphs, and words
- Line, column, and pagebreaks
- Page orientation [Ref. 1]

Ventura's multiple-file format, framed based document capability, modular components, and flexibility make it a powerful publication tool.

IV. DOCUMENT DESIGN

This chapter focuses on the hard copy and electronic document design.

A. HARD COPY DOCUMENT DESIGN

Hard copy design was focused around incorporating all user requirements and keeping printing costs as low as possible. Using a desktop publisher eliminated the cost of paying a designer or layout artist and the cost of typesetting. A four page document would cost approximately $800 for layout and typesetting. Based on this estimate, layout and typesetting for the ITM Faculty Research Catalog would have cost approximately $7200.

1. Overall Document Design

The contents of the catalog were arranged by the seven categories of information identified by user requirements. One chapter was allowed for each category of information. The chapters were arranged as follows:

- Chapter One: Message from the Chair
- Chapter Two: Overview
- Chapter Three: Faculty
- Chapter Four: Faculty Research Areas
- Chapter Five: Research Centers and Laboratories
- Chapter Six: Recent Research Sponsors
- Chapter Seven: Recent Publications

Review of faculty research catalogs from MIT and New York University lead to development of unique chapter designs that were complementary to every other chapter within the document. Items like ruling lines, fonts, font sizes, page width, photo placement, headers, and footers were designed to be consistent throughout the document.

Specifications for page layouts for each chapter can be found in Appendix A.

2. Message from the Chair

This chapter was used as an overall introduction to the catalog and was designed differently from the remaining chapters. This chapter was constructed using three files: an internal text file, an external text file and a graphic file containing the SM Chair's photo. The photo was placed in the upper left corner. Professional information was displayed in a framed box directly below the photo. Text was displayed unframed to the right of both the photo and personal information. A header and ruling line consistent with later chapters were used. One page was allowed for this chapter.

3. Overview

The primary focus of this chapter was to provide the reader with a complete description of the ITM group and their three areas of focus within a two page limit. Two text files were used for the Overview chapter, one internal and one external. Typesetting, headers, and footers, consistent with the overall document design, were used. The header design provided consistency with the Chapter One. The footer design provided layout consistency with the remainder of the catalog.

4. Faculty

The purpose of this section was to present a photo of each professor, list professional information, identify their research areas, describe their research areas, explain the relevance of their research to DoD/DoN, and list a few recent publications associated with the research described.

This chapter of the catalog was constructed using a modular design. It begins with a one page listing of all the ITM professors. This page was constructed using one internal and one external file. Header and footer designs provide consistency with the overall catalog layout. Professional information was tailored to fit the allotted space. The remaining pages in this section were constructed using one graphic, one internal text, and one external text file.

The information for each professor was placed in separate files allowing for addition or deletion of faculty as well as separate updates. The external text files and graphics files may be copied onto diskette. Professors can be provided copies of their individual files on separate diskettes. This design makes the document available to one or many for updating at any given time. Because the files can be updated outside of the publisher, there is less chance of accidental destruction of data. As mentioned above, internal text files contain document designs and must be updated within the publisher.

5. Faculty Research Areas

The contents of the Faculty Research Areas chapter were selected and categorized based on user requirements. The purpose of this chapter was to identify the ITM group's research efforts and provide brief descriptions of each. Research themes were used to identify broad categories and

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specific research areas were placed into the appropriate theme. The broad research themes and the specific research areas were arranged as follows:

- Model Management

- Database Management Systems

- Decision Support and Expert Systems
  Decision Support Systems
  Decision Making in Dynamic Environments
  Instructional Multimedia Systems

- Software Engineering and Applications Development
  Software Engineering and Project Management
  Software Reliability
  Software Metrics
  Application Development

- Networks and Communications
  Distributed Systems and Computer Networks
  Telecommunication Systems

The research information was placed in one external file. The information contained in this chapter was submitted by each professor in separate files, combined in a word processor, and imported as an external file into the publisher. Modular design for this chapter was not recommended because the large number of external files, initially twenty-three, left too much white space per page and increased the document length by seven pages. Placing all of the information in one file saves money in the short and long run. Each professor can still be provided with his specific input and a similar procedure to that used for construction

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can be used for document update.

An internal file was used for headers and footers.

6. Research Centers And Laboratories

The purpose of this chapter was to identify the ITM group's research centers, explain why each was formed, list points of contact, and describe current research projects.

Two files were used, one internal and one external. Headers, footers, font style, and font sizes used were consistent with the overall catalog design.

Photos of the laboratories were not included in this version of the catalog but are recommended for future printings.

7. Recent Research Sponsors

This chapter gives recognition to sponsors of recent research projects and was given a one page limitation. Two text files were used, one internal and one external. Header and footers used were consistent with other chapter designs. Font size and font style vary from the overall brochure design. The current one column design may need to be altered in the future to accommodate additional sponsors.

8. Recent Publications

This chapter is a composition of all recent publications of the ITM group. Publications from the Faculty chapter, Faculty Research chapter, and any additional publications that were provided by the ITM group are included in this chapter. Because of the combination of information contained in this chapter, it is recommended that future updates be implemented by one individual. Two files were used, one internal and one external. Headers, footers, font style, and font sizes used

were consistent with the overall catalog design.

B. ELECTRONIC DOCUMENT DESIGN

Electronic document design focused on implementing the ITM Group's Faculty Research Catalog on the WWW. This was to be accomplished while maintaining the document's modular design structure, maintaining document content, long term document maintenance, and maintaining as many hard copy design characteristics as possible.

The brochure was designed using the WWW page and link conventions. A page on the WWW is a document or part of a document. Relaying a central thought or topic focus. A link on a WWW page is a direct connection to another page. Links function like GOTO statements. When a user clicks on a link, a path is established to the page that is associated with the link and a new screen display of that page appears. If the link is on another host computer, the connection to that host is made automatically. Pages and links are referenced throughout this section of the thesis.

1. Overall Document Design

All of the contents of the hard copy ITM Group's Faculty Research Catalog were placed in the electronic version. The electronic catalog was linked to the SM Department's home page, which contains a complete listing of the SM curricula including the ITM Group. The ITM Group listing on this page provides the link to the electronic catalog. This selection is designed to take the user to the catalog's Table of Contents page of the electronic version.

The SM Department's home page was developed independent of the ITM Group's electronic brochure and its design will not be addressed in this paper. The HTML code for this page is

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provided in Appendix B to facilitate update of the ITM Group's electronic brochure.

All photos were converted to .gif formatted files. Pages were separated using horizontal ruling lines. A signature and status block was added at the bottom of each page. The following sections detail page design and file composition for each section of the electronic brochure. The HTML code for the electronic designs are contained in Appendix B.

2. Table of Contents Page

The Table of Contents page is the first page of the electronic brochure. One text file and 14 .gif image files were used to design this page. This page was designed to link to the remaining pages of the catalog, back to the SM Department's home page, and to the NPS home page. The Table of Contents page contains the following links:

- Message from the Chair
- Overview of the ITM Group
- ITM Faculty Research Areas
- Research Centers and Laboratories
    Decision and Information Systems Center
    Multimedia Research Laboratory
- Software Metrics Center
- Faculty
- Recent Research Sponsors
- Recent Publications
- Student Projects
- ITM Courses
- Naval Postgraduate School page
- web@sm.nps.navy.mil (signature block link)
- Return to the Systems Management Department Home Page

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3. Message From The Chair Page

The Message from the Chair page contains one text file and one .gif image file. The photo was placed on the top left corner of the page with the professional information aligned along the right hand side of the photo. Horizontal rule lines were used to separate the header from the photo and main text. The text was displayed as the next section of the page. The address and update block was placed at the end of the page. This page was designed to link back to the Table of Contents page, the SM Department's home page, and the NPS home page.

4. Overview of the ITM Group Page

The Overview of the ITM Group Page contains one text file and three .gif image files. Horizontal rule lines were used to separate the header from the main text. The text was displayed as the next section of the page. The address and update block was placed at the end of the page. This page was designed to link back to the Table of Contents page, the SM Department's home page, and the NPS home page.

5. Faculty Research Areas Page

The Faculty Research Areas Page was split into the following five sections in order to parallel the hard copy design.

- Model Management
- Database Management Systems
- Decision Support and Expert Systems
- Software Engineering and Applications Development
- Networks and Communications

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One text file and four .gif image files were used to design this page. The address and update block was placed at the end of the page. Each page was designed to link back to the Table of Contents page, the SM Department's home page, and the NPS home page. Five internal links were included in the page design to provide quick access to each of the five sections contained in this page. This section is contained in one file in the hard copy catalog. The design of this page facilitates future segmentation of files by the five sections if desired. Future segmentation of the document would decrease the risk of destruction, increase modularity, and increase update capabilities.

6. Research Centers and Laboratories

The Research Centers and Laboratories Section was split into three pages. Horizontal rule lines were used to separate the header from the main text. One text file and four .gif image files were used for each page. The address and update block was placed at the end of each page. Each page was designed to link back to the Table of Contents page, the SM Department's home page, and the NPS home page.

7. Faculty Pages

This section was patterned after the hard copy design by using an index page to list faculty members and one page for each faculty member. One text file and four .gif image files were used for the Faculty Index page. The address and update block was placed at the end of the page. The Faculty Index page was designed to link back to the Table of Contents page, the SM Department's home page, and the NPS home page.

Each professor page was composed of one text file and five .gif image files. Photos were placed on the top left corner of

each page with the professional information aligned along the right hand side of the photo. All faculty pages were linked to the Faculty Index page, the Table of Contents page, the SM Department's home page, and the NPS home page.

Using one page for each professor maintains the modular design and offers alternatives for future file maintenance. It allows updates to be made from the SM account or from the individual professor's account.

8. Recent Research Sponsors

One text file and three .gif image files were used to design this page. Horizontal rule lines were used to separate the header from the main text. The address and update block was placed at the end of the page. This page was designed to link back to the Table of Contents page, the SM Department's home page, and the NPS home page.

9. Recent Publications

One text file and nine .gif image files were used to design this page. Publications were categorized by year as in the hard copy catalog and year icons were placed next to each category heading for visual amplification. Horizontal rule lines were used to separate the header from the main text. The address and update block was placed at the end of the page. Each page was designed to link back to the Table of Contents page, the SM Department's home page, and the NPS home page.

V.   IMPLEMENTATION

Implementation is the final step in the development process. The primary objective of this phase was to construct a hard copy and electronic version of the ITM Group's Faculty Research Catalog that consolidated the group's efforts and capabilities in a physical design that satisfies users' requirements. This chapter discusses how the hard copy and electronic versions of the ITM Group's Faculty Research Catalog were implemented. In regards to the hard copy version, this chapter discusses the alternative printing methods and identifies the strengths and weakness of each. For the electronic brochure this chapter discusses the WWW implementation.

A.   HARD COPY DOCUMENT IMPLEMENTATION

Implementation of the hard copy design involved physical reproduction of the document. The Ventura publisher was used to construct the finished product. Corel Draw 5.0 was used to develop the cover page for the document. Photos were scanned in and placed on the appropriate pages of the document. High quality laser prints (600 dpi) of each page were developed. The document was submitted for three separate printings to determine the highest quality and most effective way to print the document.

The first technique was reproduction of the high quality laser prints using standard photo copying equipment (XEROX). This was the easiest reproduction technique but yielded both unsatisfactory text and photo quality. The photos were of

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poor quality and the printed text was faint and spotty.

The second technique used the high quality laser print with a document scanner attached to the printing equipment. This was an easy reproduction technique and yielded a higher quality photo reproduction and excellent text.

The third technique used the high quality laser prints but original photos were used to replace scanned prints. This technique was the most difficult and took two full weeks for reproduction. The print shop used a document scanner to scan the laser text and original photos. This method yielded the highest quality photo reproduction. This reproduction was preferred by the users.

This version was stored on tape back up with the print shop for future printings. The tape back offers update capability with full page replacement. Future document printings need only submit the request. A printed version of the catalog is contained in Appendix C.

Floppy disks were used to store all files associated with the document. This storage method will facilitate distribution of the files for annual update by the originators of the material. A laser printed copy of the changed pages will be submitted to the print shop to replace outdated pages on the tape back up. The document cover and the publications reference lists will be the primary focus for annual updates.

B. ELECTRONIC DOCUMENT IMPLEMENTATION

The brochure was coded for the WWW using the HTML Assistant and Hypertext Markup Language (HTML) 2.0 and 3.0. Each page was coded in accordance with HTML document design specifications and Naval Postgraduate School WWW standards while incorporating user requirements. HTML gives both humans and machines clues or incites about the structure,

behavior, and content of a document. It is a descriptive type of markup language. HTML is descriptive because it describes the structure and behavior of the document.[Ref. 3] On the WWW each screen that is displayed is referred to as a page. Each page on the WWW is coded with HTML 3.0 or an earlier version and designed to cover a specific idea or theme.

HTML has virtually unlimited linking capability. With HTML links can be created for locations within a document or to another document. Links appear as highlighted text in a different color from the regular text. Once a link is explored the link's color is changed for easy identification of explored links.

Page length is not restricted with HTML 3.0 nor are the number of files that can be used per page. Unlimited page length provided great flexibility in document construction allowing one page or many pages for each section of the catalog. By allowing multiple files per electronic page, HTML 3.0 provided great flexibility for maintaining the modular design of the catalog in the electronic version. The modular design also offered good security against accidental destruction of data as mentioned earlier.

The limitations encountered with HTML 3.0 were layout design limitations. HTML 3.0 has a limited capability for text display. This is because files in HTML are read by browsers and browsers are designed to read HTML files based on HTML established standards. HTML 3.0 is the current standard. When files are coded differently from the standards for a particular HTML version, the browsers interpretation is unpredictable. The file structure for HTML 3.0 is designed for one column text presentations. Photos and text headings are movable and have standards developed for different alignments and placement. Although HTML 3.0 contains paragraph justification features, there are no guidelines for

double column text presentations. Coding a document in a double column presentation, if possible, would be extremely difficult and would yield unpredictable results when read by different browsers. For this reason, the Faculty chapter of the electronic catalog varies from the hard copy design. It is presented in a one, vice two, column layout.

Next page links were added to the document. These links allow the document to be read page to page. Additional icons were added throughout the electronic version to enhance the document's visual presentation.

Written permission was obtained from individuals before their photos were placed on the WWW. All files associated with the document were placed in the IT Group's SM account on the NPS network. A copy of the electronic implementation is contained in Appendix D.

VI.   SUMMARY AND RECOMMENDATIONS

A.   SUMMARY

The ITM Group Faculty Research Catalog developed in the course of the thesis consolidates the ITM group's focus, current research projects, and past publications. The Hard Copy version is lightweight and ideal for distribution at conferences and seminars. The Electronic Catalog makes the Group's skills readily available for viewing and printing to anyone having access to the WWW. Both forms of the ITM Group Faculty Research Catalog provide a means of expanding contact with potential sponsors.

B.   RECOMMENDATIONS AND FUTURE WORK

During the development of the Electronic Catalog much thought was given to automatic update of each document page using self-maintaining software, automatic update of the number of accesses to each page, automatic Last-date-updated dates for each page, more sophisticated linking structure, and transferring each segment of the document to the originator for ownership.

Developing self-maintaining software requires a procedure that takes a flat file and parses it in search of keywords. The keywords are used to signal to the software where to establish new links and format structures. The UNIX utility, CRONTAB, can be used to set up a timer to activate the scan. Development of a self-maintaining software package for the Electronic Catalog would ensure that design consistency is maintained throughout the document and is the first step in

segmenting the document for ownership. Without this software, consistent page design across the electronic document would soon be lost.

Counters for automatic update of the number of accesses to each page are simple one up counters but would provide the faculty with statistical information regarding the exposure of the catalog.

Automatic update of the Last-date-updated dates lets users know the timeliness of the information that they are accessing. Unlike the hard copy version that is updated annually, the electronic version can be updated as the information changes. Automating this section keeps the date current with the information. Another essential feature for distribution of ownership.

 Development of a more sophisticated linking structure would allow the user to link to a wider variety of locations from each page.

Transferring each segment of the document to the originator for ownership is the ultimate goal of the Electronic form. Once the self-maintaining software and the automated features are developed segmenting the document by owner can be achieved.

APPENDIX A: HARD COPY DESIGN SPECIFICATIONS

A. GENERAL CHAPTER SETTINGS FOR ALL CHAPTERS:

```
Sides:      Singles
Layout:     Full page
Style:      Portrait
Footers:
            Left side footer:
                  Font:       Toronto Bold 8 points
                  Text:       IT Group Fraulty Research Catalog
            Right side footer:
                  Font:       Tronto Bold 8 points
                  Text:       Page number
Headers:    None
Topography: Windows:  2
            Orphans:  2
            Column Balance:ON
            Pair Kerning:ON
            All other:Default
```

B. TABLE OF CONTENTS

1. PAGE FRAME

```
Layout:
    Repeating frame:    No
    Dimensions:     Height:  11 ins          Width: 8.5 ins
    Origin:         Vertical:       0.0 in      Horizontal: 0.0 in
    Margins Inside:
                    Top:            1.275 in    Left: 1.5 ins
                    Bottom:         1.0 in      Right: 1.25 ins
    Margins Outside:    None
    Column:             Number: 1   Width:  6.0 ins
    Typography:     First Baseline: Cap-Height
                    Pair Kerning:   ON
                    All other:      Default
    Text File:      sponsors.ths
```

```
Paragraph:
    Alignment:       Horizontal Justification:    Left
                     Veritical Justification:     Top
    Leader:          Character:          .    at 46 points
                     Spacing:          2 points
    Indent:          Left:             0.25
    Tabs:            .5, 1, 1.5, 2 ins
    Text:            Characters:               Toronto Normal 12 points
                     Chapter Headings:         Toronto Bold Italics 12 points
                     Chapter Sub-Sections:     Toronto Italics 12 points
                     Page numbers:             Flush Right
                     Spacing:                  Above:      0.017 ins
                                               Below:      0.0 ins
                                               Interline:  0.194 ins
                     Grow interline space to fit:  ON
```

```
Typography:                                  Proportion    |   EMS
Justified text:      Min word spacing:           0.6       | 0.160
                     Max word spacing:           2.0       | 0.536
                     Normal word spacing:        1.0       | 0.268
```

```
Vertical Justification:  Max above:  0.194
                         Max below:  0.194
                         Interline:  0.0
Auto Hyphenation:   OFF
```

2.   TITLE FRAME

```
Repeating frame:   No
Dimensions:        Height:    0.038 ins   Width:       6.514 ins
Origin:            Vertical:  1.0 ins     Horizontal: 0.972 ins
Alignment:         Horizontal Justification:    Center
                   Veritical Justification:     Top
Margins Inside:    None
Margins Outside:   None
Column:            Number: 1                Width:   6.514 ins
Typography:        All default
Text:              Characters:      Toronto Bold Italic 36 points
                   Spacing          Above:     0.162 ins
                                    Below:     0.162 ins
                                    Interline:0.162 ins
```

```
                    Normal word spacing:   Proportion: 1.0      EMS:  0.268
                    Vertical Justification:
                                      Max above:   0.194
                                      Max below:   0.194
                                      Interline:   0.0
                    Grow interline space to fit:  ON
Ruling Line:        None
```

C.   MESSAGE FROM THE CHAIR

1.   PAGE FRAME

```
Layout:
      Repeating frame:  No
      Footers:          No
      Dimensions:       Height:  11 ins   Width: 8.5 ins
      Origin:           Vertical: 0.0 in  Horizontal: 0.0 in
      Margins Inside:   Top: 1.0 in       Left: 3.5 ins
                        Bottom: 1.0 in    Right: 1.1 ins
      Margins Outside:  None
      Column:           Number: 1         Width:  3.9 ins
      Typography:       First Baseline:   Cap-Height
                        All other:        Default
Text File:  Chairltr


Paragraph:
      Alignment:    Horizontal Justification:    Full
                    Veritical Justification:     Top
      Leader:       Character:       .   at 46 points
                    Spacing:  2 points
      Tabs:         .5, 1, 1.5, 2 ins

      Text Characters:            Toronto Normal 12 points
      Paragraph First Characters:  Toronto 18 points

      Spacing       Above:  0.194 ins
                    Below:  0.194 ins
                    Interline: 0.194 ins
                    Grow interline space to fit:  ON
```

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```
Typography:                 Proportion      | EMS
Justified text:   Min word spacing: 0.6     | 0.160
                  Max word spacing:     2.0 | 0.536
                  Normal word spacing:  1.0 | 0.268
Auto Hyphenation: OFF
```

2. TITLE FRAME

```
Repeating frame:    No
Dimensions:         Height: 0.6 ins       Width:  6.82 ins
Origin:             Vertical:  0.847 ins  Horizontal:  0.964 ins
Alignment:          Horizontal Justification:    Center
                    Veritical Justification:     Top
Margins Inside:     None
Margins Outside:    Vertical:  0.0 ins    Horizontal:  0.1 ins
Column:             Number: 1             Width:  6.82 ins
Typography:         First Baseline:       All default
Text Characters:    Toronto Bold 24 points
Spacing             Above:      0.194 ins
                    Below:      0.194 ins
                    Interline: 0.194 ins
                    Grow interline space to fit:  ON
Ruling Line:        Position: below  Thickness: 4.0 points
```

3. PHOTO FRAME

```
Dimensions:         Height:    2.66 ins   Width:  2.0 ins
Origin:             Vertical:  2.047 ins  Horizontal:  1.014 ins
Margins Inside:     None
Margins Outside:    Vertical:  0.098 ins  Horizontal:  0.098 ins
Graphics:           Half tone:  default
                    Fit to frame
                    Maintain aspect ratio
Typography:         Default
Flow text around frame: ON
```

4. PROFESSIONAL FRAME

```
Repeating frame:    No:
Dimensions:         Height:  1.95 ins     Width:      3.239 ins
```

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```
Origin:              Vertical: 5.042 in      Horizontal: 1.028 in
Margins Inside:      Top:      1 in          Left:   0 in
                     Bottom: 0 in            Right: 0 in
Margins Outside:     None
Column:              Number: 1      Width:   3.9 ins
Typography:          Default
Text:                Justification:   Center
                     Name:            Toronto Bold 11 points
                     All Others:      Toronto Normal 9 points
```

D.   OVERVIEW

1.   PAGE FRAME

```
Layout:
     Repeating frame:    No
     Dimensions:         Height:  11 ins          Width:  8.5 ins
     Origin              Vertical:  0.0            Horizontal:  0.0
     Margins Inside:     Top:  1 in          Left:        1.5 ins
                         Bottom:     1 in          Right:       1.2 ins
     Margins Outside     None
     Column              Number: 1    Width:  5.8 ins
     Typography          First Baseline: Cap-Height
                         Pair Kerning: ON
                         All other: default
     Text File:          Overview.txt
Paragraph:
     Alignment:          Horizontal Justification:  Full
                         Veritical Justification:   Top
     Leader:             Character:                 .   at 46 points
                         Spacing:                   2 points
     Tabs:               .5, 1, 1.5, 2 ins
     Text Characters:Toronto Normal 10 points
     Paragraph First Character:    Toronto 18 points
     Paragraph Headings:    Toronto Bold 11 points
     Spacing         Above:  0.194 ins
                     Below:  0.194 ins
                     Interline: 0.194 ins
                     Grow interline space to fit:  ON
```

Typography:		Proportion	EMS
Justified text: Min word spacing:		0.6	0.160
Max word spacing:		2.0	0.536
Normal word spacing:		1.0	0.268
Auto Hyphenation: OFF			

2. Title FRAME

Repeating frame:	No	
Dimensions:	Height: 0.924 ins	Width: 6.834 ins
Origin:	Vertical: 0.852 ins	Horizontal: 0.847 ins
Margins Inside:	None	
Margins Outside:	None	
Column:	Number: 1	Width: 6.834 ins
Typography:	All default	
Text:	Characters:	Toronto Bold 26 points
Spacing	Above:	0.194 ins
	Below:	0.194 ins
	Interline:	0.194 ins
	Grow interline space to fit: ON	
Ruling Line:	Position: Below, Thickness: 4.0 points	

E. FACULTY COVER

1. PAGE FRAME

Layout:

Repeating frame:	No	
Dimensions:	Height: 11 ins	Width: 8.5 ins
Origin:	Vertical: 0.0 in	Horizontal: 0.0 in
Margins Inside:	Top: 1.275 in	Left: 1.0 ins
	Bottom: 1.0 in	Right: 1.0 ins
Margins Outside:	None	
Column:	Number: 2 Width: 3.152 ins, Gutter: 0.195	
	Column Balancing: ON	
Typography:	First Baseline: Cap-Height	
	Pair Kerning: ON	
	All other: Default	
Ruling line:	Above, Thickness: 2 points, Spacing: 45	
Text File:	covered.fac	

Bullets:

    Alignment: Horizontal Justification: Left

                        Veritical Justification: Top

    Leader: Character: . at 46 points

                        Spacing: 5 points

    Indent: Left: 0.5

    Tabs: .5, 1, 1.5, 2 ins

Text Characters:

                    Toronto Normal 12 points

                    Spacing: Above: 0.256 ins

                            Below: 0.0 ins

                            Interline: 0.162 ins

                    Grow interline space to fit: ON

Typography:		Proportion	EMS
Justified text:	Min word spacing:	0.6	0.160
	Max word spacing:	2.0	0.536
	Normal word spacing:	1.0	0.268
Vertical Justification:	Max above: 0.354		
	Max below: 0.194		
	Interline: 0.0		

Auto Hyphenation: OFF

2.   TITLE FRAME

Repeating frame: No

Dimensions: Height: 0.861 ins Width: 6.5 ins

Origin: Vertical: 1.0 ins   Horizontal: 1.0 ins

Alignment: Horizontal Justification: Center

                      Veritical Justification: Top

Margins Inside: None

Margins Outside: None

Column: Number: 1   Width: 6.5 ins

Typography: All default

Text: Characters: Toronto Bold 26 points

                    Spacing   Above: 0.162 ins

                                Below: 0.162 ins

                            Interline:0.162 ins

```
                    Normal word spacing:
                                    Proportion: 1.0      EMS: 0.268
                    Vertical Justification:
                            Max above:  0.194
                            Max below:  0.194
                            Interline:  0.0
                    Grow interline space to fit:  ON
Ruling Line:        Below, Thickness:  4.0 points,  Spacing: 0.0
```

F.   FACULTY

1.   PAGE FRAME

```
Frame:
        Repeating frame:  No
        Dimensions:       Height:      11 ins       Width: 8.5 ins
        Origin:           Vertical:    0.0 in       Horizontal: 0.0 in
        Margins Inside:   Top:         1.275 in     Left:        1.0 ins
                          Bottom:      1.0 in       Right:       1.0 ins
        Margins Outside:  None
        Column:           Number: 2
                          Width:            3.152 ins
                          Gutter:           0.195
                          Balancing:        ON
        Typography:       First Baseline:   Cap-Height
                          All other:        Default
```

```
Text files:
page 5: Hamid.fac        page 10:    Emery.fac     page 15:    Schneide.fac
page 6: Bhargava.fac     page 11:    Frew.fac      page 16:    Sengupta.fac
page 7: Buddenberg.fac   page 12:    Haga.fac      page 17:    Sridhar.fac
page 8: Bui.fac          page 13:    Kamel.fac
page 9: Dolk.fac         page 14:    Ramesh.fac
```

```
Paragraph:
        Alignment:  Horizontal Justification:     Full
                    Veritical Justification:      Top
        Leader:     Character:        .   at 46 points
                    Spacing:         2 points
        Tabs:       .5, 1, 1.5, 2 ins
```

```
Text:
    Paragraph:         Toronto Normal 10 points
    Name:              Toronto Normal 10 points
    Title:             Toronto Normal 10 points
    Degree & School:Toronto Normal  8 points
    Phone Number:      Toronto Normal  9 points
    email Address:   Toronto Normal  9 points
    Spacing:           Above:      0.162 ins
                       Below:      0.162 ins
                       Interline:  0.162 ins
                       Grow interline space to fit:  ON
```

Typography:	Proportion	EMS
Justified text:Min word spacing:	0.6	0.160
Max word spacing:	2.0	0.536
Normal word spacing:	1.0	0.268

```
Vertical Justification:
              Max above   0.194 ins
              Max below   0.194 ins
              Interline   0.0
Auto Hyphenation: OFF
```

2.   PHOTO FRAME

```
Frame:
    Repeating frame:   NO
                       Frames are copied to each page, then photos are
                            added
    Dimensions:        Height: 1.575 ins       Width: 1.520 ins
    Origin:            Vertical:  0.785 ins    Horizontal: 0.847 ins
    Margins Inside:    None
    Margins Outside:   Vertical: 0.177 ins     Horizontal: 0.2 ins
    Graphics:          Half tone:        Default
                       Fit to frame:     ON
                       Maintain aspect ratio:  ON
    Typography:        Default

Photo files:
page 5:  Hamid.gif        page 10: Emery.gif   page 15:   Schneide.gif
page 6:  Bhargava.gif     page 11: Frew.gif    page 16:   Sengupta.gif
```

page 7:   Buddenberg.gif   page 12: Haga.gif   page 17:   Sridhar.gif
page 8:   Bui3.gif   page 13: Kamel.gif
page 9:   Dolk2.gif   page 14: Ramesh.gif

3.   RESEARCH AREA HEADER FRAME

Frame:

    Repeating frame: No:
    Dimensions: Height: 0.250 ins   Width: 3.1 ins
    Origin: Vertical: 0.986 ins   Horizontal: 2.625 ins
    Margins Inside: None
    Margins Outside: Vertical: 0.177 ins   Horizontal: 0.2 ins
    Column: Number: 1   Width: 3.1 ins
    Typography: Default
    Ruling Lines: Position: Below
                         Thickness: 1.3   points
                         Spacing: 0.1   points

Text:

    Justification: Left
    Name: Toronto Bold 12 points
    Spacing: Above: 0.194 ins
                         Below: 0.194 ins
                         Interline: 0.233 ins
                         Grow interline space to fit: ON

Typography:	Proportion	EMS
Justified text:Min word spacing:	0.6	0.160
Max word spacing:	2.0	0.536
Normal word spacing:	1.0	0.268

    Vertical Justification:
            Max above   0.194 ins
            Max below   0.194 ins
            Interline   0.0
    Auto Hyphenation: OFF

4.   RESEARCH DESCRIPTION HEADER FRAME

Frame:

Repeating frame:	No	
Dimensions:	Height: 0.250 ins	Width: 3.1 ins
Origin:	Vertical: 1.978 ins	Horizontal: 4.350 ins
Margins Inside:	None	
Margins Outside:	Vertical: 0.177 ins	Horizontal: 0.2 ins
Column:	Number: 1	Width: 3.1 ins
Typography:	Default	
Ruling Lines:	Position: Below	
	Thickness: 1.3 points	
	Spacing: 0.1 points	

Text:

Justification:	Left
Name:	Toronto Bold 11 points
Spacing:	Above: 0.178 ins
	Below: 0.178 ins
	Interline: 0.178 ins
	Grow interline space to fit: ON

Typography:	Proportion	EMS
Justified text:Min word spacing:	0.6	0.160
Max word spacing:	2.0	0.536
Normal word spacing:	1.0	0.268

Vertical Justification:

Max above	0.194 ins
Max below	0.194 ins
Interline	0.0
Auto Hyphenation:	OFF

5.   RELEVANCE TO DoD/DoN HEADER FRAME

Frame:

Repeating frame:	No:	
Dimensions:	Height: 0.250 ins	Width: 3.150 ins
Origin:	Vertical: 1.978 ins	Horizontal: 4.350 ins
Margins Inside:	None	
Margins Outside:	Vertical: 0.177 ins	Horizontal: 0.2 ins
Column:	Number: 1	Width: 3.15 ins

```
Typography:            Default
Ruling Lines:          Position:    Below
                       Thickness:   1.3   points
                       Spacing:     0.1   points
```

Text:
```
    Justification:     Left
    Name:              Toronto Bold 11   points
    Spacing            Above:          0.178 ins
                       Below:          0.178 ins
                       Interline: 0.178 ins
                       Grow interline space to fit:   ON
```

Typography:	Proportion	EMS
Justified text:Min word spacing:	0.6	0.160
Max word spacing:	2.0	0.536
Normal word spacing:	1.0	0.268

```
Vertical Justification:
            Max above    0.194 ins
            Max below    0.194 ins
            Interline    0.0
Auto Hyphenation:    OFF
```

6.   RECENT PUBLICATIONS HEADER FRAME

Frame:
```
    Repeating frame:   NO
    Dimensions:        Height: 0.250 ins       Width: 3.150 ins
    Origin:            Vertical: 4.558 ins     Horizontal: 4.350 ins
    Margins Inside:    None
    Margins Outside:   Vertical: 0.177 ins     Horizontal: 0.2 ins
    Column:            Number: 1   Width: 3.15 ins
    Typography:        Default
    Ruling Lines:      Position:    Below
                       Thickness:   1.3   points
                       Spacing:     0.1   points
```

Text:
```
    Justification:     Left
    Name:              Toronto Bold 11   points
```

```
Spacing                Above:          0.178 ins
                       Below:          0.178 ins
                       Interline:  0.178 ins
                       Grow interline space to fit:  ON
```

Typography:	Proportion	EMS
Justified text:Min word spacing:	.6	.160
Max word spacing:	2.0	.536
Normal word spacing:	1.0	.268

```
Vertical Justification:
        Max above   0.194 ins
        Max below   0.194 ins
        Interline   0.0
Auto Hyphenation:   OFF
```

G.   FACULTY RESEARCH AREAS

1.   PAGE FRAME

```
Layout:
    Repeating frame:   No
    Dimensions:        Height:     11 ins      Width: 8.5 ins
    Origin:            Vertical:   0.0 in      Horizontal: 0.0 in
    Margins Inside:    Top:        0.841 in    Left:       1.5 ins
                       Bottom:     0.820 in    Right:      1.1 ins
    Margins Outside:   None
    Column:            Number: 1            Width:  5.9 ins
    Typography:        First Baseline:   Cap-Height
                       Pair Kerning:     ON
                       All other:        Default
    Ruling Lines:      Placement:        Around
                       Thickness:        0.9 points
                       Spacing:          59 points
    Vertical Rule 1:   Position:   7.65 ins
                       Thickness: 0.111 inches
    Text File:         composit.rsh

Paragraph:
    Alignment:     Horizontal Justification:    Full
```

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```
                    Veritical Justification:    Top
      Leader:        Character:        .  at 46 points
                     Spacing:          2 points
      Tabs:          .5, 1, 1.5, 2 ins


      Text:          Characters:       Toronto Normal 10 points
                     Paragraph first character:   Toronto 18 points
                     Major Headings:  Toronto Bold 14 points
                     Sub Headings:    Toronto 12 points
                     Publication's Section:
                              Headings:  Toronto Bold Italics 9 points
                              Text:      Toronto Normal 9 points
                     Spacing:  Above:     0.162 ins
                               Below:     0.162 ins
                               Interline: 0.162 ins
                     Grow interline space to fit:  ON
```

Typography:		Proportion	EMS
Justified text:	Min word spacing:	0.599	0.160
	Max word spacing:	2.0	0.536
	Normal word spacing:	1.0	0.268

```
   Vertical Justification:   Max above:  0.194
                             Max below:  0.194
                             Interline:  0.0
   Auto Hyphenation:   OFF


Bullets:
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                     Vertical Justification:      Top
      Text:          Page 18:    Toronto Italic 12 points
                     Page 20:    Toronto Normal  9 points
      Indent:        All lines, Left: 0.5   Right: 0
      Spacing        Above:           0.11 ins
                     Below:           0.0 ins
                     Interline:       0.194 ins
                     Grow interline space to fit:  ON
```

2. TITLE FRAME

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                     Veritical Justification:     Top
Margins Inside:      None
Margins Outside:     Vertical:  .1 ins       Horizontal:  .2 ins
Column:              Number: 1               Width:  5.222 ins
Typography:          All default
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                                Below:      0.162 ins
                                Interline:  0.162 ins
                     Vertical Justification:
                                Max above:  0.194
                                Max below:  0.194
                                Interline:  0.0
                     Grow interline space to fit:  ON
Ruling Line:         Below, Thickness:       points
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H. RESEARCH CENTERS AND LABORATORIES

1. PAGE FRAME

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    Origin:              Vertical:    0.0 in       Horizontal: 0.0 in
    Margins Inside:      Top:         0.841 in     Left: 1.5 ins
                         Bottom:      0.820 in     Right: 1.5 ins
    Margins Outside:     None
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    Typography:          First Baseline:    Cap-Height
                         Pair Kerning:      ON
                         All other:         Default
    Text File:           composit.ctr
Paragraph:
    Alignment:           Horizontal Justification:    Full
```

```
                    Veritical Justification:    Top
Leader:             Character:        .    at 46 points
                    Spacing:          2 points
Tabs:               .5, 1, 1.5, 2 ins


Text:               Characters:               Toronto Normal 10 points
                    Paragraph first character:  Toronto 18 points
                    Major Headings:           Toronto Bold 12 points
                              Two line spaces above
                              One line space below
                    Spacing:  Above:        0.162 ins
                              Below:        0.162 ins
                              Interline:  0.162 ins
                    Grow interline space to fit:  ON
```

Typography:		Proportion	EMS
Justified text:	Min word spacing:	0.599	0.160
	Max word spacing:	2.0	0.536
	Normal word spacing:	1.0	0.268

```
Vertical Justification:   Max above:  0.194
                          Max below:  0.194
                          Interline:  0.0
Auto Hyphenation:   OFF


Bullets:
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                    Vertical Justification:       Top
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                    Center of Page 26:Toronto Italics 10 points
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                    Below:         0.0 ins
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                    Grow interline space to fit:   ON
    Auto Adjust:    By percent
    Typography:     Max above:   0.194
                    Max below:   0.194
                    Interline:   0.0
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                          proportion: 1      EMS: 0.268
```

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                                    Below:    0.162 ins
                                    Interline:0.162 ins
                    Vertical Justification:
                                    Max above:  0.194
                                    Max below:  0.194
                                    Interline:  0.0
                    Grow interline space to fit:  ON
Ruling Line:        Below,     Thickness: 2.0 points
```

I.   RECENT RESEARCH SPONSORS

1.   PAGE FRAME

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Paragraph:
    Alignment:          Horizontal Justification:   Full
```

```
                    Veritical Justification:      Top
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Tabs:               .5, 1, 1.5, 2 ins


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                              Below:         0.162 ins
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                    Grow interline space to fit:  ON
```

Typography:		Proportion	EMS
Justified text:	Min word spacing:	0.6	0.160
	Max word spacing:	2.0	0.536
	Normal word spacing:	1.0	0.268

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Vertical Justification:  Max above:   0.194
                         Max below:   0.194
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Auto Hyphenation:   OFF
```

2.   TITLE FRAME

```
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Typography:         All default


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                    Normal word spacing:
                              Proportion: 1.0      EMS: 0.268
```

```
                    Vertical Justification:
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                              Max below:  0.194
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                    Grow interline space to fit:  ON
Ruling Line:        Below, Thickness:  4.0 points
```

J.   RECENT PUBLICATIONS

1.   PAGE FRAME

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                          Bottom:      1.0 in        Right: 1.0 ins
      Margins Outside:    None
      Column:             Number: 1               Width:  6.5 ins
      Typography:         First Baseline:    Cap-Height
                          Pair Kerning:      ON
                          All other:         Default
      Vertical Justification:
                          Max above:  0.0
                          Max below:  0.0

      Grow interline space to fit:  ON

      Text File:          Publica1

Paragraph:
      Alignment:          Horizontal Justification:    Full
                          Veritical Justification:     Top
      Leader:             Character:      .   at 46 points
                          Spacing:        2 points
      Indent:             Left:      0.375
      Tabs:               .5, 1, 1.5, 2 ins

      Text:               Characters:     Toronto Normal 12 points
```

```
                    Spacing:            Above:      0.162 ins
                                        Below:      0.162 ins
                                        Interline:  0.162 ins
                    Grow interline space to fit:  ON
                    Major Headings:  Tronto Bold 14 points


Typography:                               Proportion      |   EMS
Justified text:    Min word spacing:          0.6     |  0.160
                   Max word spacing:          2.0     |  0.536
                   Normal word spacing:       1.0     |  0.268


Vertical Justification:  Max above:  0.194
                         Max below:  0.194
                         Interline:  0.0
Auto Hyphenation:    OFF


Publication Entries:
    Magazines/Journals:        Publication Number
                               Authors
                               Tittle
                               Magazine/Journal
                               Volumn Number
                               Number
                               Dates
                               Pages


    Conferences/Symposiums:    Publication Number
                               Authors
                               Title
                               Conference/Symposium/Colloquium and
                                       Location
                               Date
                               Pages


    NPS Technical Reports:     Publication Number
                               Authors
                               Title
                               NPS Technical Report
                               Department
                               NPS Serial Number
                               Date
```

2.   TITLE FRAME

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Typography:	All default
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	Below: 0.291 ins
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	Vertical Justification:
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	Interline: 0.0
	Grow interline space to fit: ON
Ruling Line:	Below, Thickness: 4.0 points

APPENDIX B: HTML CODED PAGES FOR THE ELECTRONIC CATALOG

A. SYSTEMS MANAGEMENT HOME PAGE DESIGN

```
<HTML><HEAD><TITLE>Systems Management Department Home Page</TITLE>
</HEAD> <H1><img src="/images/nps_seal.gif"></p> Naval Postgraduate
School Monterey, CA</p>Systems Management Department</H1>
<HR><pre>Systems Management Department
Phone: (408) 656-2472  Fax: (408) 656-3407
Code SM
555 Dyer Road
Naval Postgraduate School
Bldg: Ingersoll Hall
Monterey CA 93943
Room: 229 </PRE>
<HR><BODY><A NAME=local-top-of-page>  </A><blink>
 DISCLAIMER:</blink> This is just a temporary home page for the Systems
Management Department in the absence of any other official department
page. We take no personal responsibility for ensuring completeness of
the information on this page.
<BR>The Department of Systems Management can be reached at
(408) 656-2472.<HR>   <BR><UL>
<LI> Chairman <A HREF="sm/whip.shtml">David R. Whipple</A>
<LI> Overview of Systems Management Department
<LI> Research Centers
<LI> Curricula
<UL> <LI> <A HREF="sm/it.shtml">Information Technology Management</A>
<LI> Transportation Logistics Management
<LI> Transportation Management
<LI> <a href = "~stone/contracting.html">Acquisition & Contract
Management</a>
<LI> <a href = "~stone/acquisition.html">Systems Acquisition
Management</a>
<LI> Allied Officers, DoD Civilians, USA, USMC and USCG
<LI> Systems Inventory Management
<LI> Resource Planning and Management for International Defense
<LI> Material Logistics Support Management
```

```
<LI> Financial Management
<LI> Manpower/Personnel Training Analysis
</UL></UL>
<BR><HR><UL><LI>
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</UL></BODY>  <hr>
<img src="/images/eb.gif"> Go <a href="/early_bird/early.shtml">HERE</a>
for the current issue of the <b>Early Bird</b>.  <hr>
<a href="current_stats.shtml"><img src="/images/graph.xbm"> Server
statistics can be viewed here.</a>  <hr>
Authorized users can go <a href="/auth_users">HERE</a> for more files.
<hr><img src="/images/new.gif"> The Webmasters' Page can be accessed <a
href="/webmaster/web.shtml">HERE</a> <img src="/images/new.gif">  <hr>
<b>This document has been accessed 802 times.</b> </p>
Any questions or comments: Please contact
<A HREF="mailto:web@sm.nps.navy.mil"><address>
web@sm.nps.navy.mil</address></a>
Last updated on: 10 Feb 95 <hr>
<b>This server supports and utilizes Netscape (Copyright) enhanced
extensions.</b>
<br></HTML>
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B. INFORMATION TECHNOLOGY MANAGEMENT HOME PAGE DESIGN

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Naval Postgraduate School Monterey, CA</p>
Systems Management Department</p>
Information Technology Management</H1>
<HR><pre>Information Technology Management
Phone: (408) 656-2472
Fax: (408) 656-3407
Code SM
555 Dyer Road
Naval Postgraduate School
229 Ingersoll Hall
Monterey CA 93943
</pre> <HR>
<BODY><A NAME=local-top-of-page></A> <BR>
<img align=bottom src = "http://sm.nps.navy.mil/images/redbull.gif"> <A
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HREF="Admin/overview.html">  Overview of IT Group<br>
<img align=bottom src = "http://sm.nps.navy.mil/images/redbull.gif"> <A
HREF="Admin/res_comp.html"> Research in Information Technology
Management<br>
<img align=bottom src ="http://sm.nps.navy.mil/images/redhole.gif">
Research Centers<br>
<img align=bottom src ="http://sm.nps.navy.mil/images/redhole.gif"> <A
HREF="http://sm.nps.navy.mil/DISC/disc.html"> Decision and Information
Systems Research Center <br>
<img align=bottom src ="http://sm.nps.navy.mil/images/redhole.gif"> <A
HREF="metrics.shtml">Software Metrics Research Center</A><br>
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HREF="Admin/publicat.html">List of Publications<br>
<img align=bottom src ="http://sm.nps.navy.mil/images/redhole.gif"><A
HREF="students/students.shtml">StudentProjects<a/><br>
<img align=bottom src ="http://sm.nps.navy.mil/images/redhole.gif"> <A
HREF=""http://sm.nps.navy.mil/courses.shtml">ITM Courses</a><br>
<BR><HR>
<A HREF="http://www.nps.navy.mil/">Naval Postgraduate School page</A>
<br>
</BODY> <hr>
<b>This document has been accessed 318 times.</b></p>
Any questions or comments: Please contact<A
HREF="mailto:web@sm.nps.navy.mil"><address>web@sm.nps.navy.mil</address>
</a> Last updated on: 28 Jan 95</p>
<a href = "http://sm.nps.navy.mil/smhome.shtml"><img src =
"/images/home_btn.gif">Return to the Systems Management Department Home
Page</a></HTML>
```

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C. MESSAGE FROM THE CHAIR HOME PAGE DESIGN

```
<HTML>
<!--..................................................................-->
   <--FACULTY RESEARCH CATALOG: Message from the Chair Section-->
<!--..................................................................-->
 <HEAD> <TITLE> MESSAGE FROM THE CHAIR </TITLE> </HEAD>
 <BODY>
 <img align=left src = "/images/harris.gif"> <H1> Message from the Chair
</H1>    <HR size = 10 > <BR> <BR>
     <address>
     <B>Reuben T. Harris</B>
      Chair, Department of Systems Management
      Code SM/HR, Ingersoll Hall
      Room 229
      408-656-2161
      DSN 878-2161
      Fax (408) 656-3407
      rharris@nps.navy.mil
     </address>
     <BR> <BR><BR>
```

   `<B> W</B>`elcome! I want to introduce you to the Department of
Systems Management at the Naval Postgraduate School. Our department
has the largest and most diverse faculty and student body at the Naval
Postgraduate School. We have eleven different curricula, ranging from
financial management to acquisition and contract management to
information technology management. With over seventy full-time faculty
and more than 500 graduate students, we proudly claim to be DoD s
premier Graduate School of Management .`<P>`

   `<B> T</B>`his brochure is one of our ways of establishing closer
connection with our customers present and future who are interested in
Information Systems, one of our core areas of expertise. Over the past
six years we have built one of the best information systems faculties in
the world. The purpose of this brochure is to describe the faculty their
accomplishments, capabilities, and aspirations and to showcase their
achievements that have impactfully addressed a range of DoD s recent and
current problems. To be sure, this group of professionals is impressive
both in terms of their educational preparation and their demonstrated

commitment to advancing the frontiers of this important field.<P>

    <B> A</B>s you peruse the following pages, I m confident that you
ll be as impressed with the achievements and potential of our faculty
and their graduate student advisees as I ve been these past few years.
As you skim through the narratives that describe my colleagues interests
and capabilities or as you review the summaries of our collective areas
of expertise, I m sure you ll conclude that we offer a research and
studies-and-analysis capability that is difficult to replicate.<P>

    <B> G</B>ive me a call if you d like further information on the
Department of Systems Management and our abilities to assist you.<P>

 <HR>

    <!--Return to the ITM Catalog's Table of Contents Home page-->
    <a href = "http://sm.nps.navy.mil/sm/it.shtml> <img align = middle
src = "/images/itm_logo.gif"> Return to the ITM Group's Home page </A>

<HR>
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    "/images/home_btn.gif"> Return to the Systems Management
Department Home page </A> <HR>
    <!--GOTO NPS Home Page -->
    <a href = "http://www.nps.navy.mil/"> <img align = middle src =
"http://sm.nps.navy.mil/images/npslogol.gif> Naval Postgraduate School
Home page </A> <P> <HR>   <P>
    <address>
        Barbara L. Franklin -- blfrankl.nps.navy.mil
        Page last updated:
    </address>
    </BODY>
    </HTML>

D. OVERVIEW HOME PAGE DESIGN

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.......................-->
   <!--FACULTY RESEARCH CATALOG: OVERVIEW Section   -->
<!--...

<center>62</center>

```
. . . . . . . . . . . . . . . . . . . . . . -->
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 <HR size  = 10 > <BR> <BR>
```

<B> W</B>e are rapidly moving from an era of information scarcity to
one of abundance. Until very recently, information technology was
expensive, time consuming, and error prone; by historical standards, it
is now cheap, fast, and reliable.<P>

 Because of these changes, the use of information technology often
offers the most attractive means of increasing an organization's
effectiveness and reducing its use of capital resources and personnel.
The changes have been so profound that it is becoming common to regard
the new era as the Information Age, in which information technology in
all its forms becomes a fundamental determinant of a nation's or
organization's ability to thrive in the Nineties and beyond. <P>

The importance of information technology is, of course, widely
recognized in the Navy and Department of Defense. For many technical,
economic, demographic, and political reasons, the U.S. must emphasize
improved quality rather than quantity in its military force structure.
Applications of computer technology provide one of the important avenues
for achieving such quality. This is manifested in the growing
proliferation and power of smart weapons. Information technology is
important not only in weapons systems; it is also an essential
ingredient in improved command and control systems. Success in C2
warfare and C4I for the warrior is totally dependent on wisely
deployed information technology. Any fundamental improvements in the
efficiency an effectiveness of managing the military services   for
example, in logistics, human resource management, and financial control
 will almost certainly require the use of computer-based systems.<P>

 The most recent Defense Critical Technologies Plan selects 20 areas
of technology that are regarded as the most critical in supporting the
military needs of the United States. Information technology is a direct
or indirect ingredient of almost all of these critical areas. Because
of its leadership role in many aspects of information technology, the
U.S. has gained an advantage compared to its potential military
adversaries.<P>

 The Information Technology Management (ITM) group of the Systems
Management Department of the Naval Postgraduate School consists of 13
faculty members. The masters program in ITM typical has an enrollment

of about 100 students at a given point in time.<P>

An important distinguishing characteristic of the faculty is its focus
on the application of   computer-based systems, especially in DoN/DoD
environments. Although their work frequently involves advanced
technology, it is not only advances in technology that motivate the
teaching and research of the group. It is, rather, the understanding of
existing technology and the development of new technology that
potentially makes it possible to develop more efficient and effective
information systems within the DoN/DoD context.<P>

The ITM group provides a unique resource within the DoD. Its
well-recognized competence and wide range of interests equips the group
to provide assistance to DoN and DoD agencies in several ways. These
can be broken down into 1) research, 2) prototype systems development,
and 3)executive education.<P>

<B>Research</B>. In order to tackle the increasingly difficult
challenges of implementing effective information systems, management in
the private sector as well as the DoD and other government agencies
needs to gain a better understanding of the issues. The unique
character and scale of the DoD makes it especially difficult to
implement successful systems. There is a lot that we do not know about
how systems can be made more effective, how we can develop them more
quickly and cheaply, and how we can cope with the organizational changes
required. The research being conducted by the ITM group is aimed at
dealing with such questions.<P>

The ITM group is well qualified to engage in multi-disciplinary
research aimed at dealing with difficult problems recognized as
important by the leadership of a DoN or DoD agency. The group is most
effective in dealing with challenging research tasks that require deep
technical competence, viewpoints drawn from multiple disciplines, and
effort spread over a number of months or even a few years. Faculty
members are motivated to publish the results of their research as
contributions to technical and management literature.<P>

<B> Prototype systems development</B>. Working as they do in an
applied area, faculty members are generally interested in seeing their
work put into practice. Although faculty members usually do not have
the time to develop full-scale production systems, they can play a
valuable role in assisting in the development of prototype systems that

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demonstrate and verify concepts. Contemporary application development
tools   particularly those available on microcomputers   make it
feasible to undertake significant development projects. Once a concept
has been demonstrated as practical and useful, it is then generally
possible for an appropriate technical group to translate the concept
into a working production system.<P>

The graduate students at NPS provide a valuable resource for doing
such prototype developments. They are typically quite experienced in
DoD matters, and have been well trained in information technology.
Furthermore, they have received the kind of breadth in related areas
such as management, economics, accounting, etc, required to deal
effectively with real world problems. Each student is required to
perform a research project and write a thesis that represents a
significant piece of work. A prototype project of the type envisioned
here serves as an ideal source of thesis topics. Working closely
with one or more faculty members, a highly professional team of students
can be assembled to deal with important ITM topics.<P>

<B> Executive education</B>. It is becoming increasingly well
recognized that one of the critical success factors in applying
information technology is to obtain executive leadership. The technical
staff can be held responsible for developing good technical solutions,
but the task of translating organizational needs into information
systems specifications must come from the top leaders. That is the role
for general management.<P>

In order to play that role effectively, an executive should know
something about the technology and how it can serve the needs of the
organization. Such a leader need not should not   be concerned with
strictly technical matters. He or she does, however, need to know the
strengths and weaknesses of information systems, have a reasonable
appreciation for the difficulty of implementing a system, and understand
the tradeoffs involved in balancing the costs and benefits of a proposed
system.<P>

The ITM group is well qualified to develop and present tailored
executive education programs. It has wide experience in teaching in a
variety of environments. Its special familiarity with DoN and DoD
matters permits the group to use relevant and appropriate examples and
case materials. It has the resources including graduate students

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seeking interesting thesis topics to develop tailored material for a
particular DoD audience.<P>

 <HR>
    <!--Return to the ITM Catalog's Table of Contents Home page-->
     <img align = middle
src = "/images/itm_logo.gif"> Return to the ITM Group's Home page </A>
<HR>

<!--Return to ITM Faculty Home page-->
 <img align =
middle src = "/images/itm_logo.gif"> Return to ITM Faculty Home page
</A> <HR>
 <!--Return to Systems Mgmt Dept Home Page-->
  <img src = "/images/home_btn.gif">
Return to the Systems Management Department Home page </A> <HR>
 <!--GOTO NPS Home Page --> <img
align = middle src = "http://sm.nps.navy.mil/images/npslogol.gif> Naval
Postgraduate School Home page </A> <P> <HR>
 <P>
  <address>
  Barbara L. Franklin -- blfrankl.nps.navy.mil
  Last Updated On:
  </address> </BODY>   </HTML>

E.   FACULTY INDEX HOME PAGE DESIGN

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<!--..
.......................-->
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<LI>   <A href = Admin/Faculty/hamid_unix.html" Tarek K. Abdel-Hamid</A>,

66

Professor (1986)*; PhD, MIT Sloan School of
Management, 1984.
<LI>   <A href = Admin/Faculty/hamid_unix.html" Hermant K. Bhargava</A>,
Assistant Professor (1989); PhD, University of Pennsylvania, 1990.
<LI>   <A href = Admin/Faculty/hamid_unix.html"Rex Buddenberg ,
Lecturer (1993); MS, Naval Postgraduate School, 1986.
<LI>   <A href = Admin/Faculty/hamid_unix.html"Tung X. Bui ,
Associate Professor (1984); PhD, New York University, 1985.
<LI>   <A href = Admin/Faculty/hamid_unix.html"Daniel Dolk ,
Associate Professor (1982); PhD, University of Arizona, 1982.
<LI>   <A href = Admin/Faculty/hamid_unix.html"James C. Emery ,
Professor (1993); PhD, MIT Sloan School of Management, 1965.
<LI>   <A href = Admin/Faculty/hamid_unix.html"Barry Frew , Associate
Professor (1984); MS, Naval Postgraduate School, 1984.
<LI>   <A href = Admin/Faculty/hamid_unix.html"William James Haga ,
Visiting Associate Professor (1988); PhD, University of Illinois, 1972.
<LI> <A href = Admin/Faculty/hamid_unix.html" Magdi N. Kamel ,
Assistant Professor (1988); PhD, University of
Pennsylvania, 1988.
<LI>   <A href = Admin/Faculty/hamid_unix.html"Balasubramanian Ramesh
, Assistant Professor (1990); PhD, New York
University, 1992.
<LI>   <A href = Admin/Faculty/hamid_unix.html"Norman Schneidewind ,
Professor (1971); DBA, University of Southern
California, 1966.
<LI> <A href = Admin/Faculty/hamid_unix.html" Kishore Sengupta ,
Associate Professor (1989); PhD, Case Western Reserve University, 1990.
<LI>   <A href = Admin/Faculty/hamid_unix.html" Surest Sridhar ,
Visiting Assistant Professor (1994); PhD, Vanderbilt University, 1995.
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F.   FACULTY HOME PAGE DESIGNS

1.   Abdel-Hamid's Home Page Design

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  Professor
  PhD, MIT Sloan School of
  Management,  1984
  (408) 656-2686
  3991p@vml.cc.nps.navy.mil
</address>
  <H3> <U> Research Areas</U></H3>
     Software Engineering, Project Management, Software Reuse, Dynamic
Decision  Making, and System Dynamics
<H3> <U> Research Description</U></H3>
     Over the last ten years, my research has focused on applying the
```

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system dynamics modeling technique to study the dynamics of software project management. This has led to the development of a hierarchy of interrelated models to study single-project dynamics, multi-project dynamics (e.g., multiple projects sharing common resources), and organization-wide dynamics (e.g., impacts of organization-wide policies for software reuse). Through modeling and simulation, these models serve as experimentation laboratories to study software project management phenomena and gain a better understanding of the dynamically complex interactions and trade-offs that characterize software project management.<P>

In addition, the models serve as computer-based management support tools to evaluate/design organizational policies (e.g., setting software reuse goals, allocating quality assurance resources, etc.). The models are currently being used in more than forty organizations worldwide (organizations such as NASA, Hewlett-Packard, and Siemens).<P>

I am using my suite of simulation tools as experimenation microworlds to study dynamic decision making in the software management domain (e.g., study the impact of individualistic versus cooperative reward schemes on project resource allocations). I am also working on the development of intelligent tutoring interfaces to the system dynamics models of software project management in order to use them as learning laboratories for NPS students and DoD software project managers. (This is analogous to the use of flight simulators in training pilots.)<P>

<H3><U>Relevance to DoD/DoN</U></H3>
The impressive innovations in the technology of software production that have been made over the last three decades have not been matched by a corresponding maturity in the capability to manage the production of software. As a result, there continues to be too many project failures, marked by cost overruns, late deliveries, poor reliability, and user dissatisfaction.<P>
Recently, it has become more and more evident within DoD that in software, product innovation is no longer the primary bottleneck to progress, the bottleneck is project management innovation.<P>
<H3><U>Recent Publications</U></H3>
Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck.   The Effect of Reward Structures on Allocating Shared Staff Resources Among Interdependent Software Projects: An Experimental Investigation. <U>IEEE Transactions on Engineering Management</U> Vol. 41, No. 2, (May

1994):115-125.<P>

Abdel-Hamid, T., K Sengupta, and D. Ronan.   Software Project Control: An   Experimental Investigation of Judgment under Fallible Information. <U> IEEE Transactions on Software Engineering</U> Vol. 19 (June 1993):603-612.<P>

Sengupta, K. and Abdel-Hamid, T.K.   An Investigation of Alternative FeedbackStrategies in Dynamic Decision Making. <U> Management Science</U> (April 1993): 411-428.<P>

Abdel-Hamid, T.K.   Adapting, Correcting, and Perfecting Software Estimates: maintenance Metaphor.   <U>Computer</U> (March 1993): 20-29.<P>

Abdel-Hamid, T.K. and S.E. Madnick.   Software Project Dynamics: An Integrated Approach. New York: Prentice-Hall, (1991).<P>
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2.   Bhargava's Home Page Design

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                Hemant K. Bhargava
                Assistant Professor
                PhD, The Wharton School
                UNIV. of Pennsylvania, 1990
                (408) 656-2264
                http://bhargava.as.nps.navy.mil
        </address>


        <H3> <U> Research Areas</U></H3>
                Decision Support Systems, Computer-Aided Modeling, Logic
Modeling,  Artificial Intelligence<P>


        <H3> <U> Research Description</U></H3>
                My research is focused on the decision sciences, and
involves computer-aided mathematical modeling, logic modeling, and
artificial intelligence.  My current work develops methods for using the
Internet to allow global sharing of computer-based  decision
technologies.  My general research interests include the modeling
process,  developing formal languages and systems for modeling and
reasoning, and exploring the interface qualitative and quantitative
methods for modeling and reasoning.<P>


        <H4>Research Projects:</H4>
         <H5><I>  DecisionNet</I></H5>
                The DecisionNet project aims to develop software
infrastructure that offers access to a globally distributed network of
modeling and decision support systems.  Using the  World Wide Web,
DecisionNet allows providers  to publicize and make available their
technologies to consumers who can search, connect to, and use them. The
project investigates several issues arising from the creation of this
electronic marketplace of decision technologies.<P>
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Integrated Modeling Environments

Computer-aided modeling environments are designed to facilitate the construction, exercise, and management of mathematical models for decision making. Representative topics investigated in this project are: Philosophy and principles of modeling; Embedded languages as an architecture for modeling systems; Extensions to formal modeling languages; Computer-aided model construction.

Post-evaluation Analysis of Mathematical Models

What-if analysis is a standard feature in decision support systems. We investigate how computer-aided modeling systems may be used to search -intelligently and automatically -complex decision spaces in order to find high quality policy options.

Fleet Mix Planning

Fleet mix planning involves determining the optimal mix of assets that an organization must hold in order to optimize its defined objective while satisfying environ- mental and organizational constraints. We survey methods for fleet planning, and develop models and decision policies for fleet mix planning in the U.S. Coast Guard.

<U>Relevance to DoD/DoN</U>

Professor Bhargava s research has been funded by the U.S. Coast Guard, the U.S. Army Artificial Intelligence Center, and by funds from DARPA/ASTO.

<U>Recent Publications</U>

Bhargava, H.K., R. Krishnan, and A.B. Whinston. On Integrating Modeling and Collaborative Technologies. <U> Journal of Organizational Computing </U> Vol 4, No 3 (1994).

Bhargava, H.K. and S.O. Kimbrough. Model Management: An Embedded Languages Approach. <U>Decision Support Systems</U> Vol 10, No 3(1993): 277-300.

Bhargava, H.K. Dimensional Analysis in Mathematical Modeling Systems: A Simple Numerical Method. <U> ORSA Journal on Computing</U> Vol 5, No 1 (1993): 33-39.

Bhargava, H.K. and R. Krishnan, Computer-aided Model Construction. Decision Support Systems Vol 9, No 1 (1993): 91-111.<P>

Bhargava, H.K., R. Krishman, and S. Mukherjee. On the Integration of Algebraic and Data Modeling Languages. <U>Annals of Operations Research </U>Vol 38 (1992): 69-95.<P>
Bhargava, H.K., S.O. Kimbrough, and R.Krishnan. Unique Names Violations, a Problem for Model Integration or You Say Tomato, I Say Tomahto. <U>ORSA Journal on Computing</U> Vol 3, No 2 (Spring 1991): 107-120.<P>
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3.   Buddenberg's Home Page Design

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<img align=left src = "/images/budden.gif">
   <address> Rex Buddenberg
     Lecturer
     MS, Naval Postgraduate School, 1986
     (408) 656-3576
     budden@nps.navy.mil
   </address>


   <H3> <U> Research Areas</U></H3>
   Computer Networks, High Availability Networking, and Radio-WAN
Development<P>


  <H3> <U> Research Description</U></H3>
   My research specializes in adaptation of commercial networking
technology for military purposes with focus on maintained  high
availability.  Military and civilian  emergency services requirements
for Computer networks generally include:<P>


<UL>
<LI>     High availability and survivability
<LI>     Extension of internetworks into radio-WAN environment to reach
mobile platforms
<LI>     Security requirements that exceed commercial Internet needs.
My work focuses on these areas
</UL>


  Radio-based WAN requirements impact protocol suites in different ways
than   conventional wired networks.  Testbed and protocol design
requirements in this area
  includes:<P>
  <UL>
<LI>
<LI>   Low interactivity networks
<LI>   Reliable multicast
<LI>   Mobile hosts
<LI>   Multiple data types with multiple QoS needs
```

<LI>   Incorporation of one-way data feeds into networks
<LI>   Fast setup requirements
</UL>
  Developing evolutionary action plans that allow incremental growth and
real action with recognition that requirements are not well known or
defined is required to achieve the desired goals in High Availibility
Networking. <P>
  These two requirements lead to several contributory topics that
include:<P>
<UL>
    <LI>   Low Earth Orbit satellites
    <LI>   Wireless network technology development
    <LI>   Network management
    <LI>   Secure messaging
    <LI>   Network protocol architecture
    <LI>   Export education to USCG, NAVSEA, NRaD on networking
    <LI>   Consulting and research work to NAVSEA (submarinesyscom),
SPAWAR   (Next Generation Computer Resources), NAVAIR (NavAirWide Area
Network), and ARPA   (network-to-fleet)
    <LI>   Program planning, prototype work for Joint Oceanographic
Institution and Taking the Internet to Sea for the Oceanographic Fleet
   </UL>
  My research project, Taking the Internet to Sea, can be found at
http://vislab- www.nps.navy.mil/~seanet.<P>

   <H3><U>Relevance to DoD/DoN</U></H3>
    Continued operations and high levels of survivability are often
required for todays computer networks. With regards to WAN s, taking
the Internet to the fleet represents major improvement in C3I
systems.<P>

    <H3><U>Recent Publications</U></H3>
   Buddenberg, Rex. <U>Computer Networking and C3I Systems for
Emergency Services</U>, (1993). Available on:<P>
    <UL>
    <LI>ftp.nps.navy.mil in pub/sm/budden/text_word or ~/text_wp and on
http://vislab- www.nps.navy.mil/~budden
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    Buddenberg, Rex.   Ship-Shore Packet Switching.   Masters Thesis,
Navy Postgraduate School (1986).<P>

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4.   Bui's Home Page Design

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        Associate Professor
        PhD, New York UNIV., 1985
        (408) 656-2630
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          3967P@navpgs.bitnet
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<U> Research Areas</U>

  Decision and Negotiation Support Systems, Implementation of
Information
Systems in
  Large Organizations<P>

<U> Research Description</U>

  My primary research interests include implementation of information
systems in large   organizations, group decision and negotiation support
systems, crisis management   support systems, and design of distributed
knowledge-bases for organization decision   making. My research has
been fun ded by a number of DoD agencies (such as the   Office of the
Director of Defense Information, SPACECOM, NAVAIR, TRADOC)   and
international science foundations (such as the Canada Council for Social
Sciences,   the Swiss National Science Foundation, and the Hong Kong
Science Foundation).   <P>

Research Projects:

<I>Collaborative Multimedia Systems for Crisis Management</I>
  Given   the   constant   change   in   economic   and   social conditions,
the formulation   of a comprehensive strategic plan to deal with
crises is an ever increasingly urgent,   complex task. The proposed
project applies state-of-the- art collaborative multimedia   technology
to the design of computer-based systems that support crisis
management.<P>

<I> Negotiation Support Systems for Inter-Cultural Negotiation</I>

  This research focuses on the design, implementation and evaluation of
negotiation   support systems to support intercultural, multi-language
negotiations.   This approach seeks to expand current research in the
field of computerized group decision and negotiation to an
international context in which cultural and linguistic issues constitute
an integral part of the negotiation process.<P>

Supporting Argumentation in Software Development Project
  The purpose of this research is to develop an argumentation language

to support   software development projects managed in a geographically dispersed setting and in an   asynchronous mode.<P>

<H5><I> Design of a Distributed Decision Support System for Optimizing the Utilization of Military Satellite Resources</I></H5>
The management of military telecommunications services in a crisis situation requires adhoc, quick planning and negotiation among different organizations involved in the   deployment, use, and financing of satellite resources. This research proposes an   enterprise-wide computing architecture to support a variety of geographically dispersed functional tasks yet centrally managed by SPACECOM.<P>

<H3><U>Relevance to DoD/DoN</U></H3>

My research directly impacts on the efficiency and effectiveness of the SPACECOM   organization.<P>

<H3><U>Recent Publications</U></H3>

Binbasioglu, T. Bui and Ma.   An Action-Resource Language for Argumentation: The Case of Softwood Lumber Negotiation.   <U>28th Hawaii International Conference in System Sciences</U> (January 1995).<P>

Bui, Tung and Mak. An Empirical of Neural Networks in Strategic Decision Making.   <U>Proceedings of WITS, Vancouve</U> (December 1994).<P>
Bui, Tung and Petrazzini. Vietnam: Rapid Growth and Cautious Reform. <U>Telecommunications Journal</U> (October 1994).<P>
Bui, Tung and Mak. Modeling Expert s Knowledge: The New Product Entry   Problem. <U> IEEE Conference of Software Engineering</U>, Austin, Texas (April 1994).<P>
Bui, Tung.   Evaluating Negotiation Support Systems: A Conceptualization , <U>27th   Hawaii International Conference in System Sciences</U>, Vol 3 (January 1994).<P>
Bui, T. and Strand. A Neural Net Model to Represent Negotiators Heuristics.   <U>25th   Hawaii International Conference in System Sciences</U> Vol 3 (January 1993).<P> <HR>
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5.   Dolk's Home Page Design

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       Professor
       PhD, UNIV of Arizonia, 1982
       (408) 656-2260
       0541p@vm1.cc.nps.navy.mil
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<H3> <U> Research Areas</U></H3>
```

Model Management and Evolutionary Information Systems<P>

<U> Research Description</U>

Decision making and application system development are two vital
activitesfor organizations in the Information Age. Both processes
depend heavily uponmodels as vehicles for representing the context in
which decisions are made and
systems   function. Conceptual modeling is central to understanding
organizational
  requirements for computing technology.<P>

My research has been primarily dedicated to the development of
computing environments which facilitate the representation,
integration, andunderstanding of mathematical models for decision
making. Much of this work has involvedstatic models such as
mathematical programming, statistics, and database design.<P>

My current interest is in information systems as evolutonary artifacts
which are rich in dynamic behavior. Understanding the interplay between
organizations and computing technology requires recognition of the
essentially nonlinear, feedback-based nature of   the phenomena being
modeled. I am particularly interested in approaching enterprise
modeling from this perspective and am looking to recent advances in the
theory of complex adaptive systems as a guide for providing more robust
models from which decision support and information systems can
prosper.<P>

<U>Relevance to DoD/DoN</U>

The cost of application system development and maintenance in DoD is
staggering. The search for lower cost alternatives to the current modus
operandi has reached Holy Grail status. Radical solutions may be
required. Approaching system development as a generative, dynamic
phenomenon rather than a static structured process may offer insight
into more effective ways to control this activity.<P>

<U>Recent Publications</U>

Dolk, D.R. and M.H. Ackroyd. The Role of Object Technology in
Enterprise Modeling.   <U>Naval Postgraduate School Technical
Report</U>, Systems Management Department, Monterey, CA 93943 (1995).<P>

Dolk, D.R. and K.J. Euske.   Model integration: Overcoming the stovepipe organization.   <U> Advances in Management Accounting</U>, Vol. 3.,   M.J. Epstein and K.M. Poston (Eds), JAI Press, Inc., (1994).<P>

Dolk, D.R. and J.E. Kottemann.   Model Integration and a Theory of Models.   <U> Decision Support Systems</U>, Vol. 9 (1993): 51-63.<P>

Dolk, D.R., D.G. Castillo, D.J. Kridel.   GOST: An active modeling system for costing and planning NASA space programs.   <U>Journal of Management Information Systems</U>,Vol. 6 No. 1 (January 1992).<P>

Dolk, D.R. and D.J. Kridel,. An active modeling system for econometric analysis.   <U> Decision Support Systems</U>, Vol. 7 (1991).<P> <HR>
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  PhD, MIT Sloan School of Management, 1965
  (408) 656-3614
  jemery@nps.navy.mil
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<H3> <U> Research Areas</U></H3>
  Application Development<P>

<H3> <U> Research Description</U></H3>
```
  The conventional process for developing application software has a
long history of   problems. The process can be characterized by the use
of a disciplined structured   methodology and programming in a 3GL
procedural language. Applications under development are often delivered
substantially over budget and schedule or not at all. Worse, the
applications, once delivered, often fail to meet the needs
of users.   Their inflexibility makes them expensive to maintain and
difficult to adapt to changing needs.<P>

  A number of new approaches seem likely to make significant
improvements in   application development. These include the use of
Commercial-Off-The-Shelf (COTS)   products, application templates,
reusable objects and components, middleware, and   4th-generation
languages. A particular challenge is to provide integrated,
interoperable   systems in a client/server environment.<P>

We are currently concentrating our research efforts on the development of information systems for the Naval Postgraduate School. The School provides a microcosm of the broader issues found throughout the Department of Defense: multiple networks, stovepipe (non-integrated) application programs, and lack of a powerful infrastructure. Our initial focus is on enhancing the campus network, providing standard directory and e-mail services, and performing a work flow analysis of administrative systems. Once an effective infrastructure is put in place, we will develop applications using COTS products, Middleware, and a client/server-based 4GL. The intention is to develop guidelines for application development, based on our experience at NPS.<P>

<H3><U>Relevance to DoD/DoN</U></H3>
 DoD spends about $30 billion a year on software development and maintenance. Cost is not the only concern: the emerging information warfare environment makes effective software development of great strategic importance. Improving the process of developing and maintaining application software is therefore of enormous importance to DOD. <P>

<H3><U>Recent Publications</U></H3>

  Emery, J.   New Approaches to Application Development, Proceedings of IT2000 Symposium, Singapore. (1995): 10.<P>

  Emery, J. C. <U>Report of the Committee on Computing</U>. Naval Postgraduate School,   Monterey, CA, (July 1994): 32.<P>

  Emery, James C. and Dani Zweig.   The Use of Ada for the Implementation of Automated Information Systems within the Department of Defense. Naval Postgraduate School (December 1993): 33.<P>

  Emery, James C.   The Global Organization as the Norm. <U>Journal of Global Information Management</U> Vol. 1 No. 3 (Summer 1993):3-4, 31, 44.<P>

  Emery, James C., Tung X. Bui and Cheryl D. Blake.   Prototyping with Application Generators: Lessons Learned from the Naval Aviation Logistics Command Management Information System Case.   Naval Postgraduate School (October 1992): 56.<P>

Emery, James C.   Downsizing the Enterprise.   <U>SIM Network</U> Vol.
7, No.1 (Jan-Feb 1992).<P>

Emery, James C.   The Strategic Implications of a Productive Software
Development   Process.   <U>Proceedings of the Workshop on Information
Technologies and Systems,   M.I.T</U>. (December 1991): 15.<P>

Emery, James C.   ADA and Management Information Systems: Policy
Issues   Concerning Programming Language Options for the Department of
Defense. Naval   Postgraduate School, Monterey, CA, (June 1991):
102.<P>
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7.   Frew's Home Page Design

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  Barry Frew
  Associate Professor
  MS, Naval Postgraduate School, 1984
  (408) 656-2924
  bfrew@nps.navy.mil
</address>

<H3> <U> Research Areas</U></H3>
Executive IT Management and Education; Software Engineering,
Project Management, & Enterprise Integration<P>

<H3> <U> Research Description</U></H3>
My research examines various approaches to executive education
with respect to  information technology management issues within DoN.
In addition, it involves the study of critical success factors for IT
management within DoD/DoN activities;  My research also involves the
study of various approaches to integrating and interconnecting
applications to increase the efficiency and effectiveness of enterprise-
wide information management support.  The intent is to develop real
applications for real use at NPS (because NPS is viewed as a microcosm
of DoN/DoD's information environment), using a wide spectrum of
technical approaches.<P>

<H3><U>Relevance to DoD/DoN</U></H3>
TOPSAIL, the result of this work, is a program for systematic and
complete coverage   of Information Technology Management topics for Navy
Flag Officers and SES   civilian employees.  The topics covered include
information management issues     relevant to DoN high level managers.
This high level education program is envisioned as a tool for improving
decisions with respect to the selection,acquisition, deployment, use and
maintenance of information system resources throughout the  DoN.<P>

<H3><U>Recent Publications</U></H3>
Frew, Barry.   Training and Educating IS Professionals  to Manage
Information     Technology in Changing Organizations.  <U> Proceedings,
SIGCPR  94, Reinventing IS: Managing Information Technology in Changing
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Organizations</U>   (March 1994).<P>


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8. Haga's Home Page Design

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         William James Haga
         Visiting Associate Professor
         PhD, UNIV of Illinois, 1972
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```
       (408) 649-5314
       (408) 649-4561 fax
       wjhaga@nps.navy.mil
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```
   <H3> <U> Research Areas</U></H3>
   System Productivity Metrics<P>
```

```
   <H3> <U> Research Description</U></H3>
```
   I am an émigré from organization theory where I enjoyed a minor
reputation for identifying the role-making process in organizations. My
IT interests are two-fold. First, I am concerned about the research
methods used to assess the productivity of information systems.
Secondly, I am drawn to look at the impact of information technology
upon work relationships in organizations and upon society and culture at
large.<P>

   I measured the effectiveness of the SACONS and APADE
contract-generation systems by collecting field data on inputs and
outputs in a pre- experimental design. I wrote a case study of DOD s
consolidation and standardization of information systems through its
Corporate Information Management program. I assisted the Office of the
Director of Defense Information in developing guidance for DOD managers
to undertake business process re-engineering. To this end, I directed
the development of the REAP database. I also proposed an automation of
the budget forecasting and planning module of the Navy Bureau of
Medicine s executive information system.<P>

   I recently helped Fleet Numerical Meterology and Oceanographic
Center experiment with focus groups as a means to assess system
effectiveness from their customers perspective.<P>

```
   <H3><U>Relevance to DoD/DoN</U></H3>
```

   My work has helped DoD organizations considering off-the-shelf
software for the automation of small purchases and contracts. I have
directly assisted the Office of the Director of Defense Information in
developing a database of organizations that are candidates for
benchmarking.   <P>

<U>Recent Publications</U>

Haga, W. J. and M. Zviran. Information Systems Effectiveness: Research Designs for Causal Inference. <U>Journal of Information Systems</U> Vol. 4 (July 1994): 141-166.<P>

Haga, W. J. and J. D. Harrigan. Planning for natural disasters: U.S. DoD Experience. <U>Proceeding of Computer Security International 93, London</U> (October 1993): 19-22.<P>

Haga, W. J. and M. Zviran. Key Issues In IS Management: The U.S. DoD Perspective. <U>Defense Analysis</U> Vol. 9, No.2 (August 1993):197-210.<P>

Zviran, M. and W. J. Haga. Question And Answer Passwords: An Empirical Evaluation . <U>The Computer Journal</U> Vol. 35, No. 3 (1993).<P>

Euske, K.J. and W. J. Haga. Process For Improving Processes: Elements and Issues. <U>Consortium for Advanced Manufacturing International-Cost Management Systems Programs, San Diego</U> (March 1993).<P>

Haga, W. J. and M. Zviran. Cognitive Passwords: Key to Easy Access Control. <U> Computers and Security</U> Vol. 9 (December 1990): 723-736.<P>

Haga, W. J. and M. Zviran. Comparison of Password Techniques. <U> Proceedings of Computer Security International 90, London</U>, (October 1990): 285-295.<P>

Henderson, D. R. and W. J. Haga. How to Account for Inflation When Taking Present Values. <U> Naval Postgraduate School Technical Report,Systems Management Department, NPS-54-90-020 (September 1990)</U><P>

Haga, W. J. and M. Zviran. Password Security: An Exploratory Study .<U> Naval Postgraduate School Technical Report, Systems Management Department</U>, NPS-54-90-011 (May 1990).<P>

Zviran, M. and W. J. Haga. A Comparison of Password Techniques for

88

Multilevel Authentication Mechanisms. `<U>` Naval Postgraduate School Technical Report, Systems Management Department`</U>`, NPS-54-90-014 (May 1990).`<P><HR>` `<BR>`

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9.   Kamel's Home Page Design

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        Magdi N. Kamel
        Associate Professor
        PhD, UNIV of Pennsylvania,
        The Wharton School, 1988
        (408)656-2494
```

        kamel@nps.navy.mil
      </address>

<H3> <U> Research Areas</U></H3>
Interoperability and Integration of Heterogeneous Databases<P>

<H3> <U> Research Description</U></H3>
      Interoperability and integration of heterogeneous databases is one
of the
main challenges facing today s medium and large-size organizations. We
are
currently pursuing two different approaches to address this problem.<P>

      The first approach addresses the theoretical and practical issues
associated with building systems that facilitate interoperability and
integration of existing systems while preserving their autonomy and
considerable investment. Foremost of these issuesis the identification
and resolution of semantic heterogeneity that exists among these
systems. To address that issue, we have developed a comprehensive
framework for identifying, classifying, and resolving semantic
heterogeneity for different data models.
      The second approach investigates methodologies to gradually
reverse-engineer old systems into new integrated and cleanly structured
systems that follow modern principles of good design, conform with the
data and process models of the enterprise, and comply with accepted
standards, therefore increasing their ability to share information with
other systems in addition to being easily maintained and enhanced.<P>

      <H3><U>Relevance to DoD/DoN</U></H3>

      One of the main challenges facing DoD/DoN is the proliferation of a
large variety of incompatible database systems and their associated
applications. As the number of databases increases, so does the need to
interoperate many of those applications and integrate them into an
overall strategic information system.<P>

      Our work addresses these issues by investigating the theoretical
and practical issues involved in building systems to facilitate the
interoperation and integration of these systems and by addressing the
issue of reverse engineering legacy system into modern systems that
facilitate data sharing and integration.<P>

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<H3><U>Recent Publications</U></H3>

Kamel, M. N.   Identifying, Classifying, and Resolving Semantic Conflicts in Distributed Heterogeneous Databases: A Case Study. <U>Journal of Database Management </U> Vol. 6, No. 1, (Winter 1995): 20-32.<P>

Ceruti, M. G. and M. N. Kamel.   Semantic Heterogeneity in Database and Data Dictionary Integration for Command and Control Systems. <U>Proceedings of the 11th Annual Department of Defense Database Colloquium, Database 94, San Diego, CA</U>
(August 1994): 65-88.<P>

Kamel, N. N., T. Song, and M. N. Kamel.   An Approach for Building and Integrated Environment for Molecular Biology Database,   <U>Journal of Distributed and Parallel Databases</U> Vol. 1, No. 3   (July 1993): 303-327.<P>

M. N. Kamel and N. N. Kamel.   The Federated Database Management System: Requirements, Issues and Solutions. <U> Journal of Computer Communications</U> Vol. 15, No. 4   (May 1992): 270-278.<P>

D. K. Hsiao and M. N. Kamel.   Heterogeneous Databases: Proliferations, Issues and Solutions. <U>IEEE Transactions on Knowledge and Data Engineering</U> Vol. 1, No. 1, (March 1989): 45-62.<P> <HR>
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10. Ramesh's Home Page Design

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          Assistant Professor
          PhD, New York UNIV, 1992
          (408) 656-2439
          ramesh@nps.navy.mil
       </address>

     <H3> <U> Research Areas</U></H3>
        Knowledge-Based Support for Systems Development
     <H3> <U> Research Description</U></H3>
```
        Large scale systems development and maintenance efforts are
often hindered because much of the richness of the design process,
namely the design rationale, involving the deliberations on alternative
design decisions is lost in the course of designing and changing such
systems. We have developed a model that is geared towards capturing the
rationales behind design decisions and using this knowledge to reason
about changes in design decisions. The use of this model for
representation and reasoning with rationale behind requirements and
design decisions will greatly aid the development and maintenance of
large scale systems. A major objective of our research is to elevate

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the process of systems maintenance to the level of specifications and the rationale behind their creation. Development of models and mechanisms to capture and reuse rationale to support various systems development activities is the primary focus of this work.<P>

Development of complex, mission critical systems involves modification, refinement and evolution of initial requirements that lead to design solutions. In order to provide intelligent and useful support to the process of design and maintenance, a formal representation of the linkages between the design solutions, the requirements and their sources is essential. A comprehensive traceability scheme should not only identity traceability linkages to be maintained, but also provide the mechanisms to support use in systems development and maintenance activities. Based on an extensive empirical study of systems development personnel, we have developed several models for
requirements traceability.<P>

<H3><U>Relevance to DoD/DoN</U></H3>
Reducing systems development and maintenance costs and improving the quality and reliability of systems are of major concern for the DoD/DoN. Our work focuses on developing models and mechanisms that will help capture knowledge about the systems development process and use this knowledge to support a variety of stakeholders involved in development and maintenance of the system as well as in future projects. Such a reuse of process knowledge is expected to increase systems development and productivity significantly.<P>

<H3><U>Recent Publications</U></H3>

Ramesh, B. and K Sengupta.   REMAP/MM: Multimedia in Decision Support with Design Rationale.   <U>Decision Support Systems</U> (November,
1994).<P>

Ramesh, B. and Luqi.   An Intelligent Assistant for Requirements Validation for Embedded Systems.   <U>Journal of Systems Integration</U> Vol. 5, No. 2. (1995).<P>

Ramesh, B. et al   Implementing Requirements Traceability. <U>Proceedings of the IEEE International Symposium on Requirements Engineering York, UK</U> (March 1995).<P>

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Ramesh, B. and K. Sengupta.   Managing Cognitive and
Mixed-Motive Conflicts in Concurrent Engineering. <U> Concurrent
Engineering Research and Applications</U> Vol. 2,(1994): 223-236.<P>

Ramesh, B. and V. Dhar.   Representation and Maintenance of
Process Knowledge for Large Scale Systems Development. <U> IEEE Expert,
Special Series on Knowledge Based Software Engineering </U> (April
1994).<P>

Ramesh, B. and M. Edwards .   Issues in the Development of a
Model for Requirements Traceability.   <U> In Proceedings of the IEEE
International Symposium on Requirements Engineering, San Diego, CA</U>
(January 1993).<P>

Ramesh, B. and V. Dhar.   Supporting Systems Development by
Capturing Deliberations during Requirements Engineering.   <U>IEEE
Transactions on Software Engineering</U> (June 1992).<P>
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11. Schneidewind's Home Page Design

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           PhD, UNIV of Southern California, 1966
           (408) 656-2719
           schneidewind@nps.navy.mill
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    <H3> <U> Research Areas</U></H3>
        Software Reliability and Software Metrics<P>


    <H3> <U> Research Description</U></H3>
    <H5><I>  Software Reliability</I></H5>
        Research was conducted on the feasibility of optimally selecting
failure data in orderto identify the optimal set of model parameters
that would result in maximum  predictive accuracy, using the
Schneidewind Software Reliability Model as a vehicle  for the research.
The research showed that significantly improved reliability predictions
can be obtained by using a subset of the failure data,
based on applying the appropriate criteria, and using the Space Shuttle
On-Board software as an example.<P>


        <H5><I> Software Metrics</I></H5>
        A comprehensive metrics validation methodology was developed
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that has six validation criteria which support the quality functions:
assessment, control and prediction. New criteria were defined and
illustrated, including: consistency, discriminative power, tracking and
repeatability. It was shown that non-parametric statistical methods
play an important role in evaluating metrics against the validity
criteria. It was also shown how metrics that have been validated on
a current project can be applied on a future project. A non-parametric
statistical method was developed for finding the critical (i.e.,
threshold) values of metrics. Critical values are identified by
applying the discriminative power criterion and are applied in quality
control to identify potentially low quality software. It was shown how
to do a cost sensitivity analysis on the critical values in order to
tradeoff the cost of inspection against the cost of software failures.
Lastly, it was shown how metrics that have been validated against the
criteria discriminative power and tracking can be used in maintenance
to:

1) establish quality control objectives; and 2) prioritize
software components (e.g., modules) and allocate resources to maintain
them.<P>

<H3><U>Relevance to DoD/DoN</U></H3>
As a result of my software reliability research, an enhanced
version of the Schneidewind Software Reliability Model was implemented
in Version 5 of the Naval Surface Warfare Center (NSWC) SMERFS software
reliability tool, which has been acquired by numerous DoD agencies and
contractors. In addition, the model is used at NSWC for research in
reliability prediction and analysis of the TRIDENT I and II
Fire Control Software.<P>

My software metrics research has also been applied by NSWC to
validate metrics for quality assurance of the TRIDENT I and II Fire
Control Software.<P>

<H3><U>Recent Publications</U></H3>
Schneidewind, Norman F. Controlling and Predicting the
Quality of Space Shuttle Software Using Metrics. <U> Software Quality
Journal</U> (1995): 49-68.<P>
Schneidewind, Norman F. Validating Metrics for Controlling
and Predicting the Quality of Space Shuttle Flight Software. <U> IEEE
Computer</U> Vol. 27, No. 8, (August, 1994): 50-57.<P>
Schneidewind, Norman F. Software Reliability Model with

Optimal Selection of Failure Data.   <U>IEEE Transactions on Software
Engineering</U> Vol. 19, No. 11 (November 1993): 1095-1104.<P>
          Schneidewind, N. F. and T.W. Keller.   Application of
Reliability Models to the Space Shuttle. <U> IEEE Software </U>Vol. 9,
No. 4 (July 1992):28-33.<P>
          Schneidewind, Norman F.   Methodology for Validating
Software Metrics. <U>IEEE   Transactions on Software Engineering</U>,
Vol. 18, No. 5 (May 1992): 410-422.<P>

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12. Sengupta's Home Page Design

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        <P> <HR size = 5> <BR>
       <img align = left src = "/images/sengupta.gif">
      <address>
            Kishore Sengupta
            Associate Professor
            PhD, Case Western Reserve UNIV., 1990
            (408) 656-3212
          kishore@nps.navy.mil
      </address>


      <H3> <U> Research Areas</U></H3>
         Decision Making and Decision Support in Dynamic Environments,
Computer- Supported collaborative Work,  Multimedia and Intelligent
Tutoring Systems<P>


      <H3> <U> Research Description</U></H3>
         My principal research interests are in the cognitive aspects
of behavioral decision theory and their application to the design of
information systems.  Research in this area is driven to two broad
goals: to engage in a systematic study of how decisions are made in
individual and collaborative situations, and to apply the findings in
formulating design principles for decision support systems.<P>


         Within the context of these objectives, I have pursued three
themes: feedback/feed forward, dynamic decision environments, and
collaborative work.  My work on feedback and feed forward examines the
comparative efficacies of different types of  feeedback and feed forward
mechanisms (particularly cognitive feedback) in improving decision
quality.  Much of this work has been conducted in dynamic decision
environments in the context of individual and collaborative work
situations.  The research questions have been examined in experimental
settings with computer-supported microworlds that incorporate the
complexities and sophistication of real-world settings.<P>


         My work in multimedia concerns the use of the technology in
the development of interactive instructional systems.  I am currently
```

examining the feasibility of building systems in domains that require
perceptual learning. One such application is in the area of night
vision goggles, which are used by aviators for flying at night. Night
vision goggles create a representation of the external environment
that is dramatically different from that perceived in daylight
conditions. Flying in such environments, therefore, requires extensive
training. My research in this area entails building a prototype
instructional system that incorporates multimedia, night vision imagery,
and synthetic visual environments.<P>

<H3><U>Relevance to DoD/DoN</U></H3>

The relevance of my research on dynamic environments to the
DoD/DoN lies in the fact that military decision situations tend to be
complex,uncertain, and dynamic. Thus, the ability to provide effective
decision support is important to performance in such environments.<P>

<H3><U>Recent Publications</U></H3>

Sengupta, K.   Cognitive Feedback in Environments
Characterized by Irrelevant Information.   <U>OMEGA: International
Journal of Management Science</U> Vol. 23 (1995):125-143.<P>

Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck.   The
Impact of Reward Structures on Staff Allocations in a Multi-project
Software Development Environment. <U> IEEE Transactions on Engineering
Management</U> Vol. 41 (1994): 115-125.<P>

Ramesh, B. and K Sengupta.   REMAP/MM: Multimedia in Decision
Support with Design Rationale.   <U>Decision Support Systems</U>
(November, (1994).<P>

Ramesh, B. and K. Sengupta.   Managing Cognitive and
Mixed-Motive Conflicts in Concurrent Engineering.   <U>Concurrent
Engineering Research and Applications </U> Vol. 2 (1994): 223-236.<P>

Abdel-Hamid, T.K. and K. Sengupta.   Software Project
Control: An Experimental Investigation of Judgment with Fallible
Information. <U> IEEE Transactions on Software Engineering</U> Vol. 19
(June 1993): 603-612.<P>

Sengupta, K. and D. Te eni.   Cognitive Feedback GDSS: Improving Control and Convergence.   <U>MIS Quarterly</U>   Vol. 17 (1993): 87-114.<P>

         Sengupta, K. and Abdel-Hamid, T.   Alternative Conceptions of Feedback in Dynamic Environments: An Experimental Investigation. <U> Management Science</U> Vol. 39 (1993): 411-428.<P><HR>
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13. Sridhar's Home Page Design

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      <address>
        Suresh Sridhar
```

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        Visiting Assistant Professor
        PhD, Vanderbilt UNIV, 1995
        (408) 656-2489
        sridhar@nps.navy.mil
    </address>

<U> Research Areas</U>
    Telecommunication Systems and Decision Support Systems<P>

<U> Research Description</U>
        The dramatic changes in computing technology coupled with
increased demands for computing power has led several organizations to
shift towards distributed computing systems. Thus, tasks are processed
in parallel by several processors under thisscenario. One of the major
research issues in this area is to optimally balance the workload among
several processors. Load balancing can be either static or dynamic. We
have proposed improved algorithms for the static load balancing problem
where the workload can be distributed in any proportion among the
processors. This also serves as a lower bound for cases where the tasks
cannot be split among processors. We are currently developing
algorithms for the dynamic load balancing problem.<P>

        The field of mobile communication networks is another area
which is becoming increasingly important. For example, cellular
networks, which fall
under this category,have been growing at an explosive rate. The
objective of this research is to develop optimal policies for
configuring cellular networks. In particular, this research will
address the following issues: management of existing facilities,
investment in expanding existing facilities and configuring new
facilities, and the impact of these decisions on the quality of
service. It attempts to answer questions such as: What policies are
required to effectively manage the network? When is a policy most
effective? What are the implications of using one policy over another?
It attempts to incorporate the various technical, operating and
regulatory constraints in developing the optimal policies. Finally, it
examines the implications of using these policies for managerial
decision-making.<P>

<U>Relevance to DoD/DoN</U>
    The results from the above research can be useful for various

agencies of the DoD/DoN in improving the effectiveness of command and control. Modern warfare requires quick deployment of personnel and sophisticated weapon systems. The use of mobile communication systems such as cellular networks enhance the provision of tactical communications to deployed forces who are constantly on the move. By using optimal policies in configuring such networks, it is possible to ensure their cost- effectiveness and maintain the specified quality of service.<P>

<H3><U>Recent Publications</U></H3>
        Gavish B. and S. Sridhar.   Economic Aspects of Configuring
Cellular Networks.   <U> Wireless Networks </U> Vol 1, No 1
(Jan.1995).<P>

        Gavish, B., J. Gerdes, and S. Sridhar.   CM3, Looking into the
Third and Fourth Dimensions of GDSS.   <U> Integration, Information and
Collaboration Models</U>.   Kluwer Academic Pub. (1994): 269-299.<P>

        Gavish, B., and S. Sridhar.   O(n) Algorithms for Load
Balancing in Distributed Computing Systems." <U> Computers and
Operations Research</U> Vol. 21,   No 3 (1991): 239-248.<P> <HR>
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Home page </A><P><HR>
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G.   RESEARCH AREAS PAGE DESIGN

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    <H1> Faculty Research Areas </H1>
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   <B>T</B>he Information Technology Management Group's current  research
efforts fall into the following five broad <A NAME = "cats">
categories</A>:
 <UL>
<LI>   <a href="#sec1"> Model Management </A> <BR>
<LI>   <a href="#sec2"> Database Management Systems </A> <BR>
<LI>   <a href="#sec3"> Decision Support and Expert Systems </A> <BR>
<LI>   <a href="#sec4"> Software Engineering and Applications Development
</A><BR>
<LI>   <a href="#sec5"> Networks and Communications </A> <BR>
</UL>
   A brief overview of each catgegory is presented below. <BR>  <BR>
<A NAME = "sec1"> <H2>Model Management </H2> </A><P><BR>
   The role of modeling is central to the understanding of organizations
and to the development of information systems  that meet the needs of
organizations.  Models are used in decision making as well as
information systems analysis and design.  Creating computer-based
environments wherein complex models can be easily represented,
manipulated, integrated, and understood is an important objective of
software engineering and decision support.<P>
     Professor Daniel Dolk's academic contributions have been in the
design and construction of software environments to support mathematical
programming and statistical analysis.  This requires the synthesis of
many different fields, including database management,  artificial
intelligence, operations research, cognitive psychology, and software
engineering.<P>
     His current interests are in object-oriented enterprise modeling,
complex adaptivesystems, and symbiotic, or active, modeling systems that
incorporate neural network, genetic algorithms, and expert system
technology to actively assist the user in data exploration as a
precursor for building good statistical models.<P>
     Computer-aided modeling environments, or model management systems,
are designed to facilitate the construction, exercise, and management of
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mathematical models for decision making.   Professor Bhargava's research
has contributed to the development of modeling environments in a
variety of ways; his niche in this field is in the use of formal logic
in developing representation and reasoning models for important
components of these systems.<P>

  Some topics investigated in Professor Bhargava's research involve
modeling principles and philosopy, architectures for modeling
environments, and system functions that involve qualitative and symbolic
reasoning. A chief contribution of his research is the embedded
languages technique that provides an architecture for building modeling
environments, allows these systems to represent and reason with a
variety of qualitative information, and integrates multiple modeling
languages.<P>

  <H5> Publications:</H5>
<PRE>
      Dolk, D.R. and D.J. Kridel.   Modeling Telecommunications Demand
Analysis. Interfaces Vol. 23, No. 2 (1993).

      Dolk, D.R. and J.E. Kottemann. Model Integration And A Theory Of
Models. Decision Support Systems, Vol. 9 (1993): 51-63.

      Dolk, D.R., D.G. Castillo,   D.J. Kridel. GOST: An active
modeling system for costing and planning NASA space programs. Journal
of Management Information Systems, Vol. 6, No. 1 (January 1992).

      Bhargava, H.K., R. Krishnan, and P. Piela.   Formalizing the
Semantics of ASCEND. Proceedings of the Twenty-Seventh International
Conference on System Sciences, Maui, HI (January 1994).

      Bhragava, H.K.   Dimensional Analysis in Mathematical Modeling
Systems: A Simple Numerical Method.   ORSA Journal on Computing Vol. 5,
No. 1,(1993): 33-39.

      Bhargava, H.K. and S.O. Kimbrough.   Model Management: An
Embedded Languages Approach.   Decision Support Systems Vol. 10:3,
(1993): 277-300.

      Bhargava, H.K. and R. Krishnan.   Computer-aided Model
Construction. Decision Support Systems Vol. 9: No. 1, (1993): 91-111.

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    </PRE>
<A HREF = "cats">(Research Categories)</A>  <BR>  <BR>
<A NAME = "sec2">  <H2>  Database Management Systems </H2> </A> <P> <BR>
 Databases and database technology are having a major impact on the
growing use of computers.  They play a major role in almost every
information system technology and all areas where computers are used.<P>
   Professor Kamel s main research interest area is the design,
implementation, and application of database systems.  Specifically, he
is interested in data modeling and query languages, data quality, data
integrity, object-oriented database systems,integration of databases
with decision support and expert systems, and interoperability and
integration issues of heterogeneous databases.<P>

 The last issue, interoperability and integration of heterogeneous
databases,is of particular interest and is the focus of his current
research activity. He is pursuing two different approaches to address
this problem.  The firstapproach addresses the theoretical and practical
issues associated with building systems that facilitate interoperability
and integration of existing systems while preserving their autonomy and
considerable investment.  The second approach investigates methodologies
to gradually reverse-engineer old systems into new integrated and
cleanly structured systems that follow modern principles of good design,
conform with the data and process models of the enterprise, and comply
with accepted standards, thereforeincreasing their ability to share
information with other systems in addition to being easily maintained
and enhanced.<P>

 <H5> Publications:</H5>

  <PRE>
      Kamel, M. N.   Identifying, Classifying, and Resolving Semantic
Conflicts in Distributed Heterogeneous Databases: A Case Study."
Journal of Database Management, Vol. 6, No. 1, (Winter 1995): 20-32.

      Ceruti, M. G. and M. N. Kamel.   Semantic Heterogeneity in
Database and Data Dictionary Integration for Command and Control
Systems.  Proceedings of the 11th Annual Department of Defense Database
Colloquium, Database 94, San Diego, CA (August 1994): 65-88.

      Kamel, N. N. , T. Song, and M. N. Kamel.   An Approach for
Building and Integrated Environment for Molecular Biology Database."
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Journal of Distributed and Parallel Databases Vol. 1, No. 3, (July
1993): 303-327.
   </PRE>
<A HREF = "cats">(Research Categories)</A><P>   <BR>  <BR>
 <A NAME = "sec3">  <H2>  Decision Support and Expert Systems</H2> </A>
<P> <BR>
   <H3>  Decision Support Systems</H3><P>
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Computer-based systems to support the various aspects of decision
making, including generation of alternatives, their evaluation and
choice.<P>

Sridhar s work focuses on group decision support systems to address
the challenges of meetings distributed in time and space. A prototype
system called the Computer Mediated Meeting Management (CM3) has been
developed to facilitate group consensus formation and to enhance the
group decision making processes.<P>

The CM3 system supports participant anonymity, triggering of new
thought processes, group memory providing fully documented meetings, and
the ability to support long duration meetings. In addition, it supports
dynamic formation of subgroups within meetings. It consists of several
modules for question generation, brainstorming, consolidation, voting,
ranking and resource allocation.<P>

```
 <H5> Publications:</H5>
  <PRE>
      Gavish, B., J. Gerdes, and S. Sridhar.  CM3 A Distributed Group
Decision Support System."  IIE TRANSACTIONS.

      Gavish, B., Gerdes, J., and S. Sridhar.   CM3, Looking into the
Third and Fourth Dimensions of GDSS."  in INTEGRATION, INFORMATION AND
COLLABORATION MODELS, Kluwer Academic Pub., 1994, 269-299.
   </PRE>    <BR>
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<H3> Decision Making in Dynamic Environments</H3><P>
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Research in dynamic decision environments is motivated by the
recognition that many   decision situations (such as combat decision
making) are dynamic in nature. Research in this area is typically
carried out with three objectives:<P>

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<UL>
<LI>Ascertain how individuals and groups cope with complex dynamic
environments, <LI>   Design appropriate organizational structures to
facilitate adaptation by teams in such environments, and <LI>
Establish design principles for building decision support systems for
dynamic environments.
</UL>
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Professor Kishore Sengupta s contribution in this area has been in
expanding our understanding of how individuals and groups make decisions
in such environments, and in establishing the comparative efficacies of
different feedback and feedforward mechanisms in dynamic environments.
He is currently examining the question of adaptive coordination in the
context of an ONR-funded project on flexible organizations.`<P>`

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<H5>   Publications:</H5>
   <PRE>
     Sengupta, K. and T. Abdel-Hamid.   Alternative Conceptions of
Feedback in Dynamic Environments:  An experimental Investigation.
Management Science, Vol. 39,(1993): 411-428.

     Abdel-Hamid, T., K. Sengupta, and D. Ronan.  Software Project
Control: An Experimental Investigation of Judgment under Fallible
Information.  IEEE Transactions on Software Engineering, Vol. 19,
(1993): 603-612.

     Sengupta, K.   Cognitive Feedback in Environments Characterized by
Irrelevant Information.   OMEGA: International Journal of Management
cience, Vol. 23 (1995): 125-143.

     Sengupta, K., C. Jones, and B. Wright.   Adding Intelligence to
Simulators for Distributed Decision Making.    Proceedings of the JDL
Symposium on Command and  Control, Monterey, CA.
   </PRE>    <BR>
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<H3>  Instructional Multimedia Systems</H3><P>
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   Instructional multimedia systems offer the potential of engendering
fundamental changes in the way we learn. The design of effective
instructional systems thus carries important implications for training
and education in the workplace. The objective of this project is to

develop and evaluate interactive multimedia systems for instruction in complex tasks.<P>

Professor Kishore Sengupta s contribution to this project has been primarily in the design and construction of multimedia systems for instruction. Much of this work has been conducted in the context of training for night vision goggles. Night vision goggles are being used widely by aviators for flying in night time and low light conditions. Such goggles are used for a wide variety of tasks, ranging from combat missions to medical evacuation procedures. The representation of the external world offered by night vision goggles is dramatically different from normal (daylight) perception. Thus, without adequate training in the use of these goggles, even otherwise experienced aviators are prone to committing errors that would not normallyoccur in daylight conditions. In the absence of suitable training mechanisms, theincreasing use of night vision goggles has been accompanied by a dramatic rise in accident rates.<P>

As part of a multi-year project funded by the Naval Air Systems Command, Professor Sengupta is building a hypermedia instructional system that willenable aviators to learn critical perceptual skills required for the effective use of night vision goggles. The system will provide self-paced instruction, along with practice and rehearsal sessions. The system will also evaluate students on their progress.<P>

<H5> Publications:</H5>
   <PRE>
        Ciavarelli, A., K. Sengupta, and W. Baer.   Night Vision Goggle
Training Technology.   Technical Report, Naval Postgraduate School,
Monterey, CA,
(1994).
    </PRE>
<A HREF = "cats">(Research Categories)</A>

<A NAME = "sec4"> <H2> SOFTWARE ENGINEERING AND APPLICATIONS
DEVELOPMENT</H2> </A><P>
   <H3> Software Engineering and Project Management</H3><P>
     Professor Abdel-Hamid has focused on applying the system dynamics modeling technique to study the dynamics of software project management. This has led to the development of a hierarchy of interrelated models to study single-project dynamics, multi-project dynamics (e.g., multiple projects sharing common resources), and organization-wide dynamics

(e.g., impacts of organization-wide policies for software reuse).
Through modeling and simulation, these models serve as experimentation
laboratories to study software project management phenomena and gain a
better understanding of the dynamically complex interactions and
trade-offs that characterize software project management.<P>

  Professor Abdel-Hamid is also working on the development of
intelligent tutoring interfaces to the system dynamics models of
software project management in order to use them as learning
laboratories for software project managers. (This is analogous to the
use of flight simulators in training pilots.)<P>

  <H5>Publications: </H5>
    <PRE>
      Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck.   The Effect of
Reward Structures on Allocating Shared Staff Resources Among
Interdependent Software Projects: An Experimaental Investigation.   IEEE
Transactions on Engineering Management Vol.41, No. 2, (May 1994):
115-125.

      Abdel-Hamid, T.K. and Sengupta, K.   Software Project Control: An
Experimental Investigation of Judgment with Fallible Information. IEEE
Transactions on Software Engineering (June 1993): 603-612.

      Sengupta, K. and Abdel-Hamid, T.K. An Investigation of
Alternative Feedback Strategies in Dynamic Decision Making.   Management
Science (April 1993): 411-428.

      Abdel-Hamid, T.K.   Adapting, Correcting, and Perfecting Software
Estimates: A maintenance Metaphor.   Computer (March 1993): 20-29.

      Abdel-Hamid, T.K. and Madnick, S.E. Software Project Dynamics: An
Integrated Approach. New York: Prentice-Hall, 1991.
    </PRE>

<H3> Software Reliability</H3><P>

  Since software process and product evolve over time, software
reliability models should be designed to selectively use failure data to
reflect this fact. To meet this need, a software reliability model with
optimal selection of failure data was developed.<P>

Professor Schneidewind has developed a software reliability model that is used by LORAL Space Information Systems and NASA at the Johnson Space Center in Houston to assist in making reliability predictions of the Space Shuttle flight software. The model predicts time to next failure and remaining failures to help assure the flight worthiness of the Shuttle software. These predictions, along with many other quality assurance techniques, provide confidence prior to launch that there will be no critical(i.e., loss of life or mission) software failures during a Shuttle mission.<P>

This model is one of only four models recommended by the American National Standards Institute/American Institute of Aeronautics and Astronautics Recommended Practice for Software Reliability. The Schneidewind model is also one of the models included in the Statistical Modeling and Estimation of Reliability Functions for Software (SMERFS) tool, developed by the Naval Surface Warfare Center, which has been acquired by hundreds of government, industrial, and academic organizations. For the development of this model and other contributions to software measurement, Dr. Schneidewind was elected a Fellow of the Institute of Electrical and Electronics Engineers in 1992.<P>
   <H5> Publications:</H5>

        <PRE>
        Schneidewind, Norman F.   Validating Metrics for Controlling and Predicting the Quality of Space Shuttle Flight Software , IEEE Computer Vol. 27, No. 8 (August, 1994): 50-57.
        Schneidewind, Norman F.   Software Reliability Model with Optimal Selection of Failure Data.   IEEE Transactions on Software Engineering, Vol. 19, No. 11, (November 1993): 1095-1104.
        Schneidewind, Norman F. and T.W. Keller.   Application of Reliability Models to the Space Shuttle. IEEE Software, Vol. 9, No. 4, (July 1992): 28-33.
        Schneidewind, Norman F.   Methodology for Validating Software Metrics.   IEEE Transactions on Software Engineering, Vol. 18, No. 5, (May 1992): 410-422.
        </PRE>

   <H3> Software Metrics</H3><P>
     The measurement of the productivity of information systems is a critical element in the legitimation, funding and development of information technology. The attraction of convenient surrogate metrics for productivity raises the possibility that the management and support

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structure for information technology, although not the technology itself, may drift into irrelevance. Developing metrics of system productivity that are validated with behavioral anchors or employ non-obtrusive instrumentation is essential to gaining support for information technology from increasingly skeptical decision makers in the top levels of management.<P>

Professor William Haga s research efforts have included the measurement of the effectiveness of the SACONS and APADE contract-generation systems through the collection of field data on inputs and outputs in a pre- experimental design. He has assisted the Office of the Director of Defense Information in developing guidance for DOD managers who undertake business process re-engineering. To this end, he directed the development of the REAP database. He also proposed an automation of the budget forecasting and planning module of the Navy Bureau of Medicine's executive information system.<P>

His emerging interest is in examining the impact of information technology upon work relationships in organizations and upon society and culture atlarge.<P>

<H5> Publications:</H5>
     <PRE>
     Haga, W J and M Zviran.   Information Systems Effectiveness: Research Designs for Causal Inference.   Journal of Information Systems, Vol. 4 (July 1994): 141-166.

     Euske, K J and W J Haga.   Process for Improving Processes: Elements and Issues.   Consortium for Advanced Manufacturing International-Cost Management Systems Program, San Diego>, (March 1993).

     Haga, W J and M Zviran.   Key Issues In IS Management: The U.S. DoD Perspective.   Defense Analysis, Vol. 9, No. 2 (August 1993): 197-210. </PRE>

<H3> Application Development</H3><P>
     Application development is concerned with the translation of information systems requirements into a working system that satisfies the requirements.<P>
     Professor Emery s recent research has focused on the problem of developing application software. The conventional software development process employing a multi-phased structured design process and writing

custom programs in a procedural language   has led to frequent budget
and schedule overruns and systems that often do not meet the changing
needs of users.<P>

A variety of new approaches to application development appear to offer
substantial potential for improving the process.   Included are the use
of application packages, templates, reusable objects and components,
middleware products to integrate components, and 4th generation
languages. <P>

Professors Emery and Frew are studying various approaches to
integrating and interconnecting applications to increase the efficiency
and effectiveness of enterprise-wide information management support.
The intent is to develop real applications for real use at NPS, because
the school is viewed as a microcosm of DoN/DoD sinformation
environment.   A wide spectrum of technical approaches is being
used,including the implementation of Commercial-Off- The-Shelf (COTS)
products for client/server use of work-group, work-flow products or
document management and fourth generation (4GL) application development
tools.   The strategy is to use DoD processes and standards in building
interoperable applications in order to develop a model for wider use
within DoD/DoN.<P>

<H5> Publications:</H5>
      <PRE>
      Emery, James C. and Dani Zweig.   The Use of Ada for the
Implementation of Automated Information Systems within the Department of
Defense.   Naval Postgraduate School (December 1993): 33.

      Emery, James C.   The Strategic Implications of a Productive
Software Development Process.   Proceedings of the Workshop on
Information Technologies and Systems, M.I.T. (December 1991): 15.

      Emery, James C.   ADA and Management Information Systems: Policy
Issues Concerning Programming Language Options for the Department of
Defense. Naval Postgraduate School, Monterey, CA, (June 1991):102.

      Emery, James C. Organizational Planning and Control Systems:
Theory and Technology, Macmillan, (1969).
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<A HREF = "cats">(Research Categories)</A>

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<A NAME = "sec5"><H2> NETWORKS AND COMMUNICATIONS</H2></A><P>

<H3> Distributed Systems and Computer Networks</H3><P>
  A paradigm has been developed for the system and software design of
distributed systems, with application to large scale computer networks
consisting of local area networks interconnected by a wide area network.
<P>
  Professor Schneidewind has developed a paradigm for the system and
software design of distributed systems with application to the Navy s
Stock Point Logistics Integrated Communications Environment (SPLICE),
which is a distributed computer network for providing high speed
logistics transaction processing to support the Navy s world-wide
material requirements. The system consists of local computer networks
and an interconnecting wide area network, the Defense Data Network.<P>
  A number of design principles are offered with particular reference
to how they can be applied to the design of distributed systems. The
major contribution to the field of distributed systems is an explanation
of how to make design decisions about distributed systems in a way that
will enhance maintainability and understandability of the software and,
at the same time, result in good system performance. An additional
objective is to recognize the implications for software quality of
various decisions which must be made in the process of specifying a
distributed system.<P>

 <H5> Publications:</H5>
     <PRE>
     Schneidewind, Norman F.   Interconnecting Local Networks to
Long-Distance Networks.   IEEE Computer, Vol. 16, No. 9, (September
1983): 15-24.

     Schneidewind, Norman F.   Distributed System Software Design
Paradigm with Application to Computer Networks.   IEEE Transactions on
Software Engineering, Vol. 15, No. 4, (April 1989): 402-412.</PRE>
<H3> Telecommunication Systems</H3><P>
  Professor Sridhar is interested in the use of quantitative and
qualitative tools for modeling, analysis, design and management of
telecommunication systems. Sridhar has developed algorithms for
optimally balancing a given workload among processors with preassigned
loads, in a distributed computing system. The processors may either
have equal or unequal processing rates. The analysis considers the case
where perfect load balancing is possible, as well as the case where only

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approximate load balancing is possible.<P>

His current research focuses on the economic aspects of configuring cellular networks. A model has been developed to determine the system configuration which will maximize the annual expected net revenues. The study includes an analysis of the impact of changes in design parameters on system configuration, the cost of competition, and its implications for the regulatory agency.<P>

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 <H5> Publications:</H5>
    <PRE>
      Gavish, B., and S. Sridhar.    O(n) Algorithms for Load Balancing
in Distributed Computing Systems.    Computers and Operations Research,
Vol. 21(3), (1991): 239-248.


      Gavish, B., and S. Sridhar,    Economic Aspects of Configuring
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H. RESEARCH CENTERS AND LABORATORIES PAGE DESIGN

1. Decision Research Center Page Design

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The Decision and Information Systems Research Center (DISC) was
established at the Naval Postgraduate School in 1995. Its research focus
is on the design,implementation, and analysis of information systems
directed at organizational computing and decision making. The Center
currently has 12 associated faculty, representing backgrounds and
research interests in decision sciences, software development,
networking, and interoperability and integration of information
technologies and modeling methodologies. DISC provides a common
identity for related research projects as well as various support
services. The Center runs an active seminar series drawing speakers
from various universities, industry, DoD organizations and research
laboratories.<P>

     DISC faculty research is sponsored by a broad range of funding
agencies, including several in the Department of Defense. Current
topics being researched by the Center's faculty include:<P>
 <UL> <LI> The use of the internet for sharing decision-oriented
information technologies
<LI>   Development of multimedia-capable intelligent-tutoring
technologies
 <LI>   Evolutionary computing
 <LI>   Investigation of new paradigms for developing organizational
computing software
 <LI>   Development of guidelines for the migration to an integrated and
interoperable client-server architecture

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    Further information about the Center is available via the World Wide
Web (http://sm.nps.navy.mil/DISC/disc.html), via electronic mail
(disc@sm.nps.navy.mil), or by calling the Professor Hemant Bhargava at
(408) 656-2264.<P>  </address>
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  The objective of the effort is to provide a vehicle for conducting
interdisciplinary research on instructional technology and in
information
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systems that utilize evolving multimedia technologies. The facility has been
in existence since 1992 and is used by faculty and students from the Information Systems, Aviation Safety, and Command & Control areas. The laboratory provides multimedia computing facilities for two platforms: MS-DOS/Windows based and UNIX based systems. Currently, we have a network of Sun workstations as well as high-end MS-DOS-based machines.<P>

  The faculty and students involved with the laboratory are pursuing research on a variety of topics, much of it in cooperation with different units of the Navy and other services. Principal areas of research include:<P>

 <UL>
 <LI>Development of a prototype computer-based system for training on night vision goggles
 <LI>   Application of Multimedia for Capturing Design Rationale
 <LI>   Design and Implementation of an Expert Advisor for Maintenance of the Mark-92 Fire Control System
 <LI>   Development of Interactive Education Media
 </UL>

 <address>
  For further information, contact Professor Sengupta, Director of the Multimedia Research Laboratory at Phone: (408) 656-3212   or via E-mail:
kishore@nps.navy.mil
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3.   Metrics Research Center Page Design

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  Increasingly, DoD is requiring the use of metrics in software
development
contracts. Although there have been significant achievements in this
area,
there exists gaps in theory and practice.  Among these are validation
methodologies, process methodologies, databases, metrics tools, and cost
analyses.   The Software Metrics Research Center was established in
response
to DoD needs to address these issues.  Here students and faculty tackle
such
issues as integration of metrics methodology into the software
life-cycle
process, development of metrics tools, and general metrics research.
Current
research projects include:<P>

  <UL>
   <LI>  Space Shuttle Software Reliability and Metrics
   <LI>  A Software Reliability Model with Optimal Selection of Failure
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Data
  </UL>

<address>    For further information, contact Professor Schneidewind,
Director
of the Software Metrics Research Center at Phone: (408) 656-2719    or
via
E-mail: Schneidewind@nps.navy.mil <P>
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I.   SPONSORS PAGE DESIGN

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 <LI>  Canada Council for Research in Social Sciences
 <LI>  Chief of Staff, Headquarters, Department of the Army
 <LI>  Coast Guard
 <LI>  Commander Military Sealift Command (MSC)
 <LI>  Commander Naval Aviation, Pacific
 <LI>  Credit Suisse, Information Systems Center of the Canton of Vaud,
Switzerland
 <LI>  Defense Information Systems Agency (DISA)
 <LI>  Defense Manpower Data Center (DMDC)
 <LI>  Hong Kong Competitive Earmarked Research Grant
 <LI>  Hong Kong University of Science and Technology
 <LI>  Marine Corp, Tactical Systems Support Activity (MCTSSA)
 <LI>  Naval Air Systems Command (NAVAIR)
 <LI>  Naval Center for Cost Analysis
 <LI>  Naval Sea Systems Command (NAVSEA)
 <LI>  Naval Surface Warfare Center (NSWC)-Dahlgren Division
 <LI>  Naval Surface Warfare Center -Port Hueneme Division
 <LI>  Office of Naval Research (ONR)
 <LI>  Pacific Bell
 <LI>  Swiss National Foundation for Scientific Research
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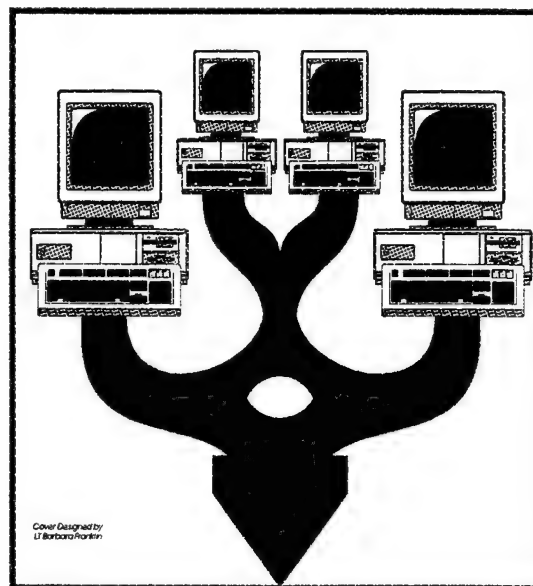
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Configuring Cellular Networks.    WIRELESS NETWORKS   Vol.  1, No. 1,
(Jan.1995).

     IT95.2  Sengupta, K.    Cognitive Feedback in Environments
Characterized by Irrelevant Information.    OMEGA: International Journal
of Management Science Vol. 23 (1995): 411- 428.

     IT95.3  Ramesh, B.    An Intelligent Assistant for Requirements
Validation for embedded systems.    Journal of Systems Integration Vol.
5, No. 2. (1995).

     IT95.4  Ramesh, B.  et al    Implementing Requirements
Traceability.  Proceedings of the IEEE International Symposium on
Requirements Engineering York, UK (March 1995).
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IT95.5 Kamel, M. N.   Identifying, Classifying, and Resolving
Semantic Conflicts in Distributed Heterogeneous Databases: A Case Study.
Journal of Database Management Vol. 6, No. 1, (Winter 1995): 20-32.

IT95.6 Binbasioglu, T. Bui, and Ma.   An Action-Resource Language
for Argumentation: The Case of Softwood Lumber Negotiation.   28th
Hawaii International Conference in System Sciences (January 1995).
    </PRE>

<H3> 1994 Publications</H3>
<PRE>
IT94.1   Ceruti, M. G. and M. N. Kamel.   Semantic Heterogeneity
in Database and Data Dictionary Integration for Command and Control
Systems.   Proceedings of the 11th Annual Department of Defense
Database Colloquium,Database 94, San Diego, CA (August 1994): 65-88.

IT94.2 Ramesh, B. and K. Sengupta .   Managing Cognitive and
Mixed-Motive Conflicts.   Concurrent Engineering Research and
Applications Vol. 2, (1994): 223- 236.

IT94.3 Sengupta, K., D. Te eni, N. Melone, M. Limayen, and S.
Weisband. Views of Work and the Design and Use of Group Support
Systems.   Accounting, Management, and Information Technology Vol. 4,
No. 4, (1994): 245-266.

IT94.4 Ramesh, B. and V. Dhar .   Representation and Maintenance
of Process Knowledge for Large Scale Systems Development.   IEEE Expert,
 Special Series on Knowledge Based Software Engineering (April 1994).

IT94.5 Schneidewind, Norman F.   Validating Metrics for
Controlling and Predicting the Quality of Space Shuttle Flight Software.
 IEEE Computer Vol. 27, No. 8, (August, 1994): 50-57.

IT94.6 Bhargava, H.K., R. Krishnan, and A.B. Whinston.   On
Integrating Modeling and Collaborative Technologies.   Journal of
Organizational Computing Vol. 4, No. 3 (1994).

IT94.7 Dolk, D.R. and K. J. Euske.   Model integration:
Overcoming the stovepipe organization.   Advances in Management
Accounting Vol. 3. M.J. Epstein and K.M. Poston (Eds),. JAI Press,
Inc., (1994).

IT94.8 Gavish, B., J. Gerdes, and S. Sridhar.   CM3, Looking into the Third and Fourth Dimensions of GDSS.   INTEGRATION, INFORMATION AND COLLABORATION MODELS. Kluwer Academic Pub. (1994): 269-299.

IT94.9 Emery, J. C. Report of the Committee on Computing. Naval Postgraduate School, Monterey, CA, (July 1994): 32.

IT94.10 Frew, Barry.   Training and Educating IS Professionals to Manage Information Technology in Changing Organizations. Proceedings, SIGCPR 94, Reinventing IS: Managing Information Technology in Changing Organizations
March 1994).

IT94.11 Haga, W. J. and M. Zviran.   Information Systems Effectiveness: Research Designs for Causal Inference.   Journal of Information Systems Vol. 4   (July 1994): 141-166.

IT94.12 Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck.   The Effect of Reward Structures on Allocating Shared Staff Resources Among Interdependent Software Projects: An Experimaental Investigation.   IEEE Transactions on Engineering Management Vol. 41, No. 2, (May 1994):115-125.

IT94.13 Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck.   The Impact of Reward Structures on Staff Allocations in a Multi-project Software
Development Environment.   IEEE Transactions on Engineering Management Vol. 41 (1994).

IT94.14 Ramesh, B., and K Sengupta.   REMAP/MM: Multimedia in Decision Support with Design Rationale.   Decision Support Systems (November, 1994).

IT94.15 Ramesh, B., and K. Sengupta.   Managing Cognitive and Mixed-Motive Conflicts in Concurrent Engineering.   Concurrent Engineering Research and Applications Vol. 2, (1994): 223-236.

IT94.16 Bui, Tung and Mak.   An Empirical of Neural Networks in Strategic Decision Making. Proceedings of WITS Vancouver (December 1994).

IT94.17 Bui, Tung and Petrazzini.   Vietnam: Rapid Growth and
Cautious Reform.   Telecommunications Journal   (October 1994).

IT94.18 Bui,Tung and Mak.   Modeling Expert s Knowledge: The New
Product Entry Problem.   IEEE Conference of Software Engineering,
Austin, Texas   (April 1994).

IT94.19 Bui, T. Evaluating Negotiation Support Systems: A
Conceptualization." 27th Hawaii International Conference in System
Sciences Vol. III (January 1994).
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    <H3> 1993 Publications</H3>
    <PRE>   IT93.1 Abdel-Hamid, T., K Sengupta, and D. Ronan.
Software Project Control: An Experimental Investigation of Judgment
under Fallible Information.   IEEE Transactions on Software Engineering
Vol. 19 (June 1993) 603-612.

IT93.2 Sengupta, K. and D. Te eni.   Cognitive Feedback GDSS:
Improving Control and Convergence.   MIS Quarterly Vol. 17 (1993):
87-114,

IT93.3 Sengupta, K. and Abdel-Hamid, T.   Alternative Conceptions
of Feedback in Dynamic Environments: An Experimental Investigation.
Management Science Vol. 39 (April 1993): 411-428.

IT93.7 Abdel-Hamid, T.K.   Adapting, Correcting, and Perfecting
Software Estimates: A maintenance Metaphor.   Computer (March 1993):
20-29.

IT93.8 Haga, W. J. and J. D. Harrigan.   Planning for natural
disasters: U.S. DoD Experience.   Proceeding of Computer Security
International 93, London (October 1993): 19-22.

IT93.9   Haga, W. J. and M. Zviran.   Key Issues In IS Management:
The U.S. DoD Perspective.   Defense Analysis Vol. 9, No. 2 (August
1993):197-210.

IT93.10 Zviran, M. and W. J. Haga.   Question And Answer
Passwords: An Empirical Evaluation . The Computer Journal Vol. 35, No.
3 (1993).

IT93.11 Euske, K.J. and W. J. Haga. Process For Improving Processes: Elements And Issues. Consortium for Advanced Manufacturing International-Cost Management Systems Programs, San Diego (March 1993).

IT93.12 Schneidewind, Norman F. Software Reliability Model with Optimal Selection of Failure Data. IEEE Transactions on Software Engineering Vol. 19, No. 11 (November 1993): 1095-1104.

IT93.13 Bhargava, H. K. and S.O. Kimbrough. Model Management: An Embedded Languages Approach. Decision Support Systems Vol. 10, No. 3 (1993): 277 300.

IT93.14 Bhargava, H. K., Dimensional Analysis in Mathematical Modeling Systems: A Simple Numerical Method. ORSA Journal on Computing Vol. 5, No. 1 (1993): 33 39.

IT93.15 Bhargava, H. K, and R. Krishnan. Computer-aided Model Construction. Decision Support Systems Vol. 9, No. 1 (1993): 91 111.

IT93.16 Buddenberg, Rex. Computer Networking and C3I Systems for Emergency Services. (1993). Available on ftp.nps.navy.mil in pub/sm/budden/text_word or ~/text_wp and on http://vislab-www.nps.navy.mil/~budden.

IT93.17 Dolk, D.R. and Kottemann, J.E. Model integration and a Theory of Models. Decision Support Systems Vol. 9 (1993): 51-63.

IT93.18 Emery, James C. and Dani Zweig. The Use of Ada for the Implementation of Automated Information Systems within the Department of Defense. Naval Postgraduate School (December 1993): 33.

IT93.19 Kamel, N. N., T. Song, and M. N. Kamel, An Approach for Building and Integrated Environment for Molecular Biology Database, Journal of Distributed and Parallel Databases Vol. 1, No. 3 (July 1993): 303-327.

IT93.20 Emery, James C. The Global Organization as the Norm. Journal of Global Information Management Vol. 1, No. 3 (Summer 1993):3-4, 31, 44.

IT93.21 Ramesh, B. and M. Edwards . Issues in the Development

of a Model for Requirements Traceability.   In Proceedings of the IEEE
International Symposium on Requirements Engineering, San Diego, CA.
(January 1993).

        IT93.22 Bui, T. and Strand.   A Neural Net Model to Represent
Negotiators Heuristics.   25th Hawaii International Conference in
System Sciences   Vol. III (January 1993).

        IT93.23 Bui, Tung.   A Neural-Network Based Behavioral Theory of
Tank Commanders, Neural Network Research for Military Applications.
(Jules Borack, Ed.), Book Chapter, NPRDC, San Diego, (1993).

        IT93.24 Bui, T,   Designing Multiple Criteria Negotiation Support
Systems:Framework and Issues.   Book Chapter, Multiple Criteria
Decision Making: Expand and enrich the Domains of Thinking and
Applications (Tzeng et al., Eds), Springer   Verlag. (December 1993).
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    <H3> 1992 Publications</H3>
    <PRE>   IT92.1 Schneidewind, N. F. and T.W. Keller.   Application
of Reliability Models to the Space Shuttle.   IEEE Software Vol. 9, No.
4 (July 1992): 28-33.

        IT92.2   Ramesh, B. and V. Dhar.   Supporting Systems Development
by Capturing Deliberations during Requirements Engineering.   IEEE
Transactions on Software Engineering (June 1992).

        IT92.3 Bui, T. and Sivasankaran.   A Stochastic Model of
Organizational Choice." Belgium Journal of Operations Research,
Statistics and Computer Science Vol. 31, No. 3-4 (1992).

        IT92.4 Bhargava, H. K., R. Krishnan, and S. Mukherjee.   On the
Integration of Algebraic and Data Modeling Languages.   Annals of
Operations Research Vol. 38 (1992): 69-95.

        IT92.5 Emery, James C., Tung X. Bui and Cheryl D. Blake.
Prototyping with Application Generators: Lessons Learned from the Naval
Aviation Logistics Command Management Information System Case.   Naval
Postgraduate School (October 1992): 56.

IT92.6   Dolk, D.R., D.G. Castillo, D.J Kridel.   GOST: An active
modeling system for costing and planning NASA space programs.   Journal
of Management Information Systems Vol. 6, No. 1 (January 1992).

IT92.7   Emery, James C.   Downsizing the Enterprise.   SIM
Network Vol. 7, No.1 (Jan-Feb 1992).

IT92.8   M. N. Kamel and N. N. Kamel.   The Federated Database
Management System: Requirements, Issues and Solutions.   Journal of
Computer Communication Vol. 15, No. 4   (May 1992): 270-278.

IT94.9   Schneidewind, Norman F.   Methodology for Validating
Software Metrics.   IEEE Transactions on Software Engineerin, Vol. 18,
No. 5 (May 1992): 410-422.   </PRE>

   <H3> 1991 Publications</H3>
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IT91.1   Gavish, B., and S. Sridhar.   O(n) Algorithms for Load
Balancing in Distributed Computing Systems."   Computers and Operations
Research Vol. 21, No. 3 (1991): 239-248.

IT91.2   Emery, James C.   The Strategic Implications of a
Productive Software Development Process.   Proceedings of the Workshop
on Information Technologies and Systems, M.I.T. (December 1991): 15.

IT91.3   Emery, James C.   ADA and Management Information Systems:
Policy Issues Concerning Programming Language Options for the Department
of Defense. Naval Postgraduate School, Monterey, CA, (June 1991): 102.

IT91.4   H.K. Bhargava, S.O. Kimbrough, and R. Krishnan.   Unique
Names Violations, a Problem for Model Integration or You Say Tomato, I
Say Tomahto. ORSA Journal on Computing Vol. 3, No. 2 (Spring 1991):
107-120.

IT91.5   Dolk, D.R. and D.J. Kridel.   An Active Modeling System
for Econometric Analysis.   Decision Support Systems, Vol. 7 (1991).

IT91.6   Abdel-Hamid, T.K. and S.E. Madnick.   Software Project
Dynamics: An Integrated Approach.   New York: Prentice-Hall, (1991).

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IT91.7 Haga, W. J. and M. Zviran.   The Practice of Password Usage: Some Empirical Evidence.   Proceedings of the Seventh Inter-national Conference on Information Security, Brighton (May 1991).
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    <H3> 1990 Publications</H3>
    <PRE>   IT90.1 Haga, W. J. and M. Zviran.   Cognitive Passwords: Key to Easy Access Control.   Computers and Security Vol. 9 (December 1990): 723-736.

    IT90.2   Emery, James C.   The Strategic Role of Information Systems. Journal of Academy of Management Information, Japan, Vol. 1, No. 1 (Nov 1990):55-82.

    IT90.3 Haga, W. J. and M. Zviran.   Comparison of Password Techniques. Proceedings of Computer Security International 90, London, (October 1990).

    IT90.4 Zviran, M. and W. J. Haga.   User Authentication by Cognitive Passwords. Proceedings of the Fifth Jerusalem Conference on Information Technology (October 1990).

    IT90.5 Henderson, D. R. and W. J. Haga.   How to Account for Inflation When Taking Present Values.   Naval Postgraduate School Technical Report, Systems Management Department, NPS-54-90-020, (September 1990).

    IT90.6 Haga, W. J. and M. Zviran.   Password Security: An Exploratory Study . Naval Postgraduate School Technical Report, Systems Management Department, NPS-54-90-011, (May 1990).

    IT90.7 Zviran, M. and W. J. Haga.   A Comparison of Password Techniques for Multilevel Authentication Mechanisms.   Naval Postgraduate School Technical Report, Systems Management Department, NPS-54-90-014.
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APPENDIX C.   HARD COPY CATALOG

INFORMATION
TECHNOLOGY
MANAGEMENT
GROUP

Cover Designed by
LT Barbara Franklin

1995
FACULTY
RESEARCH
CATALOG

SYSTEMS MANAGEMENT DEPARTMENT

Contents

Message from the Chair

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Chair, Department of

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Welcome! I want to introduce you to the Department of Systems Management at the Naval Postgraduate School. Our department has the largest and most diverse faculty and student body at the Naval Postgraduate School. We have eleven different curricula, ranging from financial management to acquisition and contract management to information technology management. With over seventy full-time faculty and more than 500 graduate students, we proudly claim to be DoD's premier 'Graduate School of Management'.

This brochure is one of our ways of establishing closer connection with our customers —present and future — who are interested in Information Systems, one of our core areas of expertise. Over the past six years we've built one of the best information systems faculties in the world. The purpose of this brochure is to describe the faculty — their accomplishments, capabilities, and aspirations — and to showcase their achievements that have impactfully addressed a range of DoD's recent and current problems. To be sure, this group of professionals is impressive — both in terms of their educational preparation and their demonstrated commitment to advancing the frontiers of this important field.

As you peruse the following pages, I'm confident that you'll be as impressed with the achievements and potential of our faculty and their graduate student advisees as I've been these past few years. As you skim through the narratives that describe my colleagues' interests and capabilities or as you review the summaries of our collective areas of expertise, I'm sure you'll conclude that we offer a research and studies-and-analysis capability that is difficult to replicate.

Give me a call if you'd like further information on the Department of Systems Management and our abilities to assist you.

Overview

We are rapidly moving from an era of information scarcity to one of abundance. Until very recently, information technology was expensive, time consuming, and error prone; by historical standards, it is now cheap, fast, and reliable.

Because of these changes, the use of information technology often offers the most attractive means of increasing an organization's effectiveness and reducing its use of capital resources and personnel. The changes have been so profound that it is becoming common to regard the new era as the Information Age, in which information technology in all its forms becomes a fundamental determinant of a nation's or organization's ability to thrive in the Nineties and beyond.

The importance of information technology is, of course, widely recognized in the Navy and Department of Defense. For many technical, economic, demographic, and political reasons, the U.S. must emphasize improved quality rather than quantity in its military force structure. Applications of computer technology provide one of the important avenues for achieving such quality. This is manifested in the growing proliferation and power of "smart" weapons. Information technology is important not only in weapons systems; it is also an essential ingredient in improved command and control systems. Success in C^2 warfare and C^4I for the warrior is totally dependent on wisely deployed information technology. Any fundamental improvements in the efficiency and effectiveness of managing the military services — for example, in logistics, human resource management, and financial control — will almost certainly require the use of computer-based systems.

The most recent Defense Critical Technologies Plan selects 20 areas of technology that are regarded as the most critical in supporting the military needs of the United States. Information technology is a direct or indirect ingredient of almost all of these critical areas. Because of its leadership role in many aspects of information technology, the U.S. has gained an advantage compared to its potential military adversaries.

The Information Technology Management (ITM) group of the Systems Management Department of the Naval Postgraduate School consists of 13 faculty members. The masters program in ITM typical has an enrollment of about 100 students at a given point in time.

An important distinguishing characteristic of the faculty is its focus on the application of computer-based systems, especially in DoN/DoD environments. Although their work frequently involves advanced technology, it is not only advances in technology that motivate the teaching and research of the group. It is, rather, the understanding of existing technology and the development of new technology that potentially makes it possible to develop more efficient and effective information systems within the DoN/DoD context.

The ITM group provides a unique resource within the DoD. Its well-recognized competence and wide range of interests equips the group to provide assistance to DoN and DoD agencies in several ways. These can be broken down into 1) research, 2) prototype systems development, and 3) executive education.

Research. In order to tackle the increasingly difficult challenges of implementing effective information systems, management in the private sector as well as the DoD and other government agencies needs to gain a better understanding of the issues. The unique character and scale of the DoD makes it especially difficult to implement successful systems. There is a lot that we do not know about how systems can be made more effective, how we can develop them more quickly and cheaply, and how we can cope with the organizational changes required. The research being conducted by the ITM group is aimed at dealing with such questions.

The ITM group is well qualified to engage in multi-disciplinary research aimed at dealing with difficult problems recognized as important by the leadership of a DoN or DoD agency. The group is most effective in dealing with challenging research tasks that require deep technical competence, viewpoints drawn from multiple disciplines, and effort spread over a number of months or even a few years. Faculty members are motivated to publish the results of their research as contributions to technical and management literature.

Prototype systems development. Working as they do in an applied area, faculty members are generally interested in seeing their work put into practice. Although faculty members usually do not have the time to develop full-scale production systems, they can play a valuable role in assisting in the development of prototype systems that demonstrate and verify concepts. Contemporary application development tools — particularly those available on microcomputers — make it feasible to undertake significant development projects. Once a concept has been demonstrated as practical and useful, it is then generally possible for an appropriate technical group to translate the concept into a working production system.

The graduate students at NPS provide a valuable resource for doing such prototype developments. They are typically quite experienced in DoD matters, and have been well trained in information technology. Furthermore, they have received the kind of breadth in related areas such as management, economics, accounting, etc, required to deal effectively with real world problems. Each student is required to perform a research project and write a thesis that represents a significant piece of work. A prototype project of the type envisioned here serves as an ideal source of thesis topics. Working closely with one or more faculty members, a highly professional team of students can be assembled to deal with important ITM topics.

Executive education. It is becoming increasingly well recognized that one of the critical success factors in applying information technology is to obtain executive leadership. The technical staff can be held responsible for developing good technical solutions, but the task of translating organizational needs into information systems specifications must come from the top leaders. That is the role for general management.

In order to play that role effectively, an executive should know something about the technology and how it can serve the needs of the organization. Such a leader need not — should not — be concerned with strictly technical matters. He or she does, however, need to know the strengths and weaknesses of information systems, have a reasonable appreciation for the difficulty of implementing a system, and understand the tradeoffs involved in balancing the costs and benefits of a proposed system.

The ITM group is well qualified to develop and present tailored executive education programs. It has wide experience in teaching in a variety of environments. Its special familiarity with DoN and DoD matters permits the group to use relevant and appropriate examples and case materials. It has the resources —including graduate students seeking interesting thesis topics — to develop tailored material for a particular DoD audience.

Faculty

- Tarek K. Abdel-Hamid, Professor (1986)*; PhD, MIT Sloan School of Management, 1984.

- Hermant K. Bhargava, Assistant Professor (1989); PhD, University of Pennsylvania, 1990.

- Rex Buddenberg, Lecturer (1993); MS, Naval Postgraduate School, 1986.

- Tung X. Bui, Associate Professor (1984); PhD, New York University, 1985.

- Daniel Dolk, Associate Professor (1982); PhD, University of Arizona, 1982.

- James C. Emery, Professor (1993); PhD, MIT Sloan School of Management, 1965.

- Barry Frew, Associate Professor (1984); MS, Naval Postgraduate School, 1984.

- William James Haga, Visiting Associate Professor (1988); PhD, University of Illinois, 1972.

- Magdi N. Kamel, Assistant Professor (1988); PhD, University of Pennsylvania, 1988.

- Balasubramanian Ramesh, Assistant Professor (1990); PhD, New York University, 1992.

- Norman Schneidewind, Professor (1971); DBA, University of Southern California, 1966.

- Kishore Sengupta, Associate Professor (1989); Case Western Reserve University, 1990.

- Surest Sridhar, Visiting Assistant Professor (1994); PhD, Vanderbilt University, 1994.

*The year of joining the Naval Postgraduate School faculty is indicated in parentheses.

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Research Areas

Software Engineering, Project Management, Software Reuse, Dynamic Decision Making, and System Dynamics

Research Description

Over the last ten years, my research has focused on applying the system dynamics modeling technique to study the dynamics of software project management. This has led to the development of a hierarchy of interrelated models to study single-project dynamics, multi-project dynamics (e.g., multiple projects sharing common resources), and organization-wide dynamics (e.g., impacts of organization-wide policies for software reuse). Through modeling and simulation, these models serve as "experimentation laboratories" to study software project management phenomena and gain a better understanding of the dynamically complex interactions and trade-offs that characterize software project management.

In addition, the models serve as computer-based management support tools to evaluate/design organizational policies (e.g., setting software reuse goals, allocating quality assurance resources, etc.). The models are currently being used in more than forty organizations worldwide (organizations such as NASA, Hewlett-Packard, and Siemens).

I am using my suite of simulation tools as "experimenation microworlds" to study dynamic decision making in the software management domain (e.g., study the impact of individualistic versus cooperative reward schemes on project resource allocations).

I am also working on the development of "intelligent" tutoring interfaces to the system dynamics models of software project management in order to use them as "learning laboratories" for NPS students and DoD software project managers. (This is analogous to the use of flight simulators in training pilots.)

Relevance to DoD/DoN

The impressive innovations in the technology of software production that have been made over the last three decades have not been matched by a corresponding maturity in the capability to manage the production of software. As a result, there continues to be too many project failures, marked by cost overruns, late deliveries, poor reliability, and user dissatisfaction.

Recently, it has become more and more evident within DoD that in software, product innovation is no longer the primary bottleneck to progress, the bottleneck is project management innovation.

Recent Publications

Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck. "The Effect of Reward Structures on Allocating Shared Staff Resources Among Interdependent Software Projects: An Experimental Investigation." IEEE Transactions on Engineering Management Vol. 41, No. 2, (May 1994):115-125.

Abdel-Hamid, T., K Sengupta, and D. Ronan. "Software Project Control: An Experimental Investigation of Judgment under Fallible Information." IEEE Transactions on Software Engineering Vol. 19 (June 1993) 603-612.

Sengupta, K. and Abdel-Hamid, T.K. "An Investigation of Alternative Feedback Strategies in Dynamic Decision Making." Management Science (April 1993): 411-428.

Abdel-Hamid, T.K. "Adapting, Correcting, and Perfecting Software Estimates: A maintenance Metaphor." Computer (March 1993): 20-29.

Abdel-Hamid, T.K. and S.E. Madnick. "Software Project Dynamics: An Integrated Approach." New York: Prentice-Hall, (1991).

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Research Areas

Decision Support Systems, Computer-Aided Modeling, Logic Modeling, Artificial Intelligence

Research Description

My research is focused on the decision sciences, and involves computer-aided mathematical modeling, logic modeling, and artificial intelligence. My current work develops methods for using the Internet to allow global sharing of computer-based decision technologies. My general research interests include the modeling process, developing formal languages and systems for modeling and reasoning, and exploring the interface qualitative and quantitative methods for modeling and reasoning.

Research Projects:

DecisionNet

The DecisionNet project aims to develop software infrastructure that offers access to a globally distributed network of modeling and decision support systems. Using the World Wide Web, DecisionNet allows providers to publicize and make available their technologies to consumers who can search, connect to, and use them. The project investigates several issues arising from the creation of this electronic marketplace of decision technologies.

Integrated Modeling Environments

Computer-aided modeling environments are designed to facilitate the construction, exercise, and management of mathematical models for decision making. Representative topics investigated in this project are: Philosophy and principles of modeling; Embedded languages as an architecture for modeling systems; Extensions to formal modeling languages; Computer-aided model construction.

Post-evaluation Analysis of Mathematical Models

What-if analysis is a standard feature in decision support systems. We investigate how computer-aided modeling systems may be used to search—intelligently and automatically—complex decision spaces in order to find high quality policy options.

Fleet Mix Planning

Fleet mix planning involves determining the "optimal" mix of assets that an organization must hold in order to optimize its defined objective while satisfying environmental and organizational constraints. We survey methods for fleet planning, and develop models and decision policies for fleet mix planning in the U.S. Coast Guard.

Relevance to DoD/DoN

Professor Bhargava's research has been funded by the U.S. Coast Guard, the U.S. Army Artificial Intelligence Center, and by funds from DARPA/ASTO.

Recent Publications

Bhargava, H.K., R. Krishnan, and A.B. Whinston. "On Integrating Modeling and Collaborative Technologies." Journal of Organizational Computing Vol 4, No 3 (1994).

Bhargava, H.K. and S.O. Kimbrough. "Model Management: An Embedded Languages Approach." Decision Support Systems Vol 10, No 3 (1993): 277-300.

Bhargava, H.K. "Dimensional Analysis in Mathematical Modeling Systems: A Simple Numerical Method." ORSA Journal on Computing Vol 5, No 1 (1993): 33-39.

Bhargava, H.K. and R. Krishnan, "Computer-aided Model Construction." Decision Support Systems Vol 9, No 1 (1993): 91-111.

Bhargava, H.K. , R. Krishnan, and S. Mukherjee. "On the Integration of Algebraic and Data Modeling Languages." Annals of Operations Research Vol 38 (1992): 69-95.

Bhargava, H.K., S.O. Kimbrough, and R.Krishnan. "Unique Names Violations, a Problem for Model Integration or You Say Tomato, I Say Tomahto." ORSA Journal on Computing Vol 3, No 2 (Spring 1991): 107-120.

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Research Areas

Computer Networks, High Availability Networking, and Radio-WAN Development

Research Description

My research specializes in adaptation of commercial networking technology for military purposes with focus on maintained high availability. Military and civilian emergency services requirements for Computer networks generally include:

- High availability and survivability

- Extension of internetworks into radio-WAN environment to reach mobile platforms

- Security requirements that exceed commercial Internet needs. My work focuses on these areas

Radio-based WAN requirements impact protocol suites in different ways than conventional wired networks. Testbed and protocol design requirements in this area includes:

- Low interactivity networks

- Reliable multicast

- Mobile hosts

- Multiple data types with multiple QoS needs

- Incorporation of one-way data feeds into networks

- Fast setup requirements

Developing evolutionary action plans that allow incremental growth and real action with recognition that requirements are not well known or defined is required to achieve the desired goals in High Availibility Networking.

These two requirements lead to several contributory topics that include:

- Low Earth Orbit satellites

- Wireless network technology development

- Network management

- Secure messaging

- Network protocol architecture

- Export education to USCG, NAVSEA, NRaD on networking

- Consulting and research work to NAVSEA (submarinesyscom), SPAWAR (Next Generation Computer Resources), NAVAIR (NavAirWide Area Network), and ARPA (network-to-fleet)

- Program planning, prototype work for Joint Oceanographic Institution and Taking the Internet to Sea for the Oceanographic Fleet

My research project, 'Taking the Internet to Sea,' can be found at http://vislab-www.nps.navy.mil/~seanet

Relevance to DoD/DoN

Continued operations and high levels of survivability are often required for todays computer networks. With regards to WAN's, taking the Internet to the fleet represents major improvement in C3I systems.

Recent Publications

Buddenberg, Rex. Computer Networking and C3I Systems for Emergency Services. (1993). Available on:

- ftp.nps.navy.mil in pub/sm/budden/text_word or ~/text_wp and on http://vislab-www.nps.navy.mil/~budden

Buddenberg, Rex. "Ship-Shore Packet Switching." Masters Thesis, Navy Postgraduate School (1986).

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Research Areas

Decision and Negotiation Support Systems, Implementation of Information Systems in Large Organizations

Research Description

My primary research interests include implementation of information systems in large organizations, group decision and negotiation support systems, crisis management support systems, and design of distributed knowledge-bases for organization decision making. My research has been funded by a number of DoD agencies (such as the Office of the Director of Defense Information, SPACECOM, NAVAIR, TRADOC) and international science foundations (such as the Canada Council for Social Sciences, the Swiss National Science Foundation, and the Hong Kong Science Foundation).

Research Projects:

Collaborative Multimedia Systems for Crisis Management

Given the constant change in economic and social conditions, the formulation of a comprehensive strategic plan to deal with crises is an ever increasingly urgent, complex task. The proposed project applies state-of-the-art collaborative multimedia technology to the design of computer-based systems that support crisis management.

Negotiation Support Systems for Inter-Cultural Negotiation

This research focuses on the design, implementation and evaluation of negotiation support systems to support intercultural, multi-language negotiations. This approach seeks to expand current research in the field of computerized group decision and negotiation to an international context in which cultural and linguistic issues constitute an integral part of the negotiation process.

Supporting Argumentation in Software Development Project

The purpose of this research is to develop an argumentation language to support software development projects managed in a geographically dispersed setting and in an asynchronous mode.

Design of a Distributed Decision Support System for Optimizing the Utilization of Military Satellite Resources

The management of military telecommunications services in a crisis situation requires adhoc, quick planning and negotiation among different organizations involved in the deployment, use, and financing of satellite resources. This research proposes an enterprise-wide computing architecture to support a variety of geographically dispersed functional tasks yet centrally managed by SPACECOM.

Relevance to DoD/DoN

My research directly impacts on the efficiency and effectiveness of the SPACECOM organization.

Recent Publications

Binbasioglu, T. Bui and Ma. "An Action-Resource Language for Argumentation: The Case of Softwood Lumber Negotiation." 28th Hawaii International Conference in System Sciences (January 1995).

Bui, Tung and Mak. "An Empirical of Neural Networks in Strategic Decision Making." Proceedings of WITS, Vancouve (December 1994).

Bui, Tung and Petrazzini. "Vietnam: Rapid Growth and Cautious Reform." Telecommunications Journal (October 1994).

Bui, Tung and Mak. "Modeling Expert's Knowledge: The New Product Entry Problem." IEEE Conference of Software Engineering, Austin, Texas (April 1994).

Bui, Tung. "Evaluating Negotiation Support Systems: A Conceptualization", 27th Hawaii International Conference in System Sciences, Vol III (January 1994).

Bui, T. and Strand. "A Neural Net Model to Represent Negotiators' Heuristics." 25th Hawaii International Conference in System Sciences Vol III (January 1993).

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Research Areas

Model Management and Evolutionary Information Systems

Research Description

Decision making and application system development are two vital activites for organizations in the Information Age. Both processes depend heavily upon models as vehicles for representing the context in which decisions are made and systems function. Conceptual modeling is central to understanding organizational requirements for computing technology.

My research has been primarily dedicated to the development of computing environments which facilitate the representation, integration, and understanding of mathematical models for decision making. Much of this work has involved static models such as mathematical programming, statistics, and database design.

My current interest is in information systems as evolutonary artifacts which are rich in dynamic behavior. Understanding the interplay between organizations and computing technology requires recognition of the essentially nonlinear, feedback-based nature of the phenomena being modeled. I am particularly interested in approaching enterprise modeling from this perspective and am looking to recent advances in the theory of complex adaptive systems as a guide for providing more robust models from which decision support and information systems can prosper.

Relevance to DoD/DoN

The cost of application system development and maintenance in DoD is staggering. The search for lower cost alternatives to the current *modus operandi* has reached Holy Grail status. Radical solutions may be required. Approaching system development as a generative, dynamic phenomenon rather than a static structured process may offer insight into more effective ways to control this activity.

Recent Publications

Dolk, D.R. and M.H. Ackroyd. "The Role of Object Technology in Enterprise Modeling." Naval Postgraduate School Technical Report, Systems Management Department, Monterey, CA 93943 (1995).

Dolk, D.R. and K.J. Euske. "Model integration: Overcoming the stovepipe organization." Advances in Management Accounting Vol. 3., M.J. Epstein and K.M. Poston (Eds), JAI Press, Inc., (1994).

Dolk, D.R. and J.E. Kottemann. "Model Integration and a Theory of Models." Decision Support Systems Vol. 9 (1993): 51-63.

Dolk, D.R., D.G. Castillo, D.J. Kridel. "GOST: An active modeling system for costing and planning NASA space programs." Journal of Management Information Systems Vol. 6 No. 1 (January 1992).

Dolk, D.R. and D.J. Kridel,. "An active modeling system for econometric analysis." Decision Support Systems Vol. 7 (1991).

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Research Areas

Application Development

Research Description

The conventional process for developing application software has a long history of problems. The process can be characterized by the use of a disciplined structured methodology and programming in a 3GL procedural language. Applications under development are often delivered substantially over budget and schedule — or not at all. Worse, the applications, once delivered, often fail to meet the needs of users. Their inflexibility makes them expensive to maintain and difficult to adapt to changing needs.

A number of new approaches seem likely to make significant improvements in application development. These include the use of Commercial-Off-The-Shelf (COTS) products, application templates, reusable objects and components, middleware, and 4th-generation languages. A particular challenge is to provide integrated, interoperable systems in a client/server environment.

We are currently concentrating our research efforts on the development of information systems for the Naval Postgraduate School. The School provides a microcosm of the broader issues found throughout the Department of Defense: multiple networks, "stovepipe" (non-integrated) application programs, and lack of a powerful infrastructure. Our initial focus is on enhancing the campus network, providing standard directory and e-mail services, and performing a work flow analysis of administrative systems. Once an effective infrastructure is put in place, we will develop applications using COTS products, Middleware, and a client/server-based 4GL. The intention is to develop guidelines for application development, based on our experience at NPS.

Relevance to DoD/DoN

DoD spends about $30 billion a year on software development and maintenance. Cost is not the only concern: the emerging "information warfare" environment makes effective software development of great strategic importance. Improving the process of developing and maintaining application software is therefore of enormous importance to DOD.

Recent Publications

Emery, J. "New Approaches to Application Development," Proceedings of IT2000 Symposium, Singapore. (1995): 10.

Emery, J. C. Report of the Committee on Computing. Naval Postgraduate School, Monterey, CA, (July 1994): 32.

Emery, James C. and Dani Zweig. "The Use of Ada for the Implementation of Automated Information Systems within the Department of Defense." Naval Postgraduate School (December 1993): 33.

Emery, James C. "The Global Organization as the Norm." Journal of Global Information Management Vol. 1 No. 3 (Summer 1993):3-4, 31, 44.

Emery, James C., Tung X. Bui and Cheryl D. Blake. "Prototyping with Application Generators: Lessons Learned from the Naval Aviation Logistics Command Management Information System Case." Naval Postgraduate School (October 1992): 56.

Emery, James C. "Downsizing the Enterprise." SIM Network Vol. 7, No.1 (Jan-Feb 1992).

Emery, James C. "The Strategic Implications of a Productive Software Development Process." Proceedings of the Workshop on Information Technologies and Systems, M.I.T. (December 1991): 15.

Emery, James C. "ADA and Management Information Systems: Policy Issues Concerning Programming Language Options for the Department of Defense." Naval Postgraduate School, Monterey, CA, (June 1991): 102.

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Research Areas

Executive IT Management and Education; Software Engineering, Project Management, & Enterprise Integration

Research Description

My research examines various approaches to executive education with respect to information technology management issues within DoN. In addition, it involves the study of critical success factors for IT management within DoD/DoN activities; My research also involves the study of various approaches to integrating and interconnecting applications to increase the efficiency and effectiveness of enterprise-wide information management support. The intent is to develop real applications for real use at NPS (because NPS is viewed as a microcosm of DoN/DoD's information environment), using a wide spectrum of technical approaches.

Relevance to DoD/DoN

TOPSAIL, the result of this work, is a program for systematic and complete coverage of Information Technology Management topics for Navy Flag Officers and SES civilian employees. The topics covered include information management issues relevant to DoN high level managers. This high level education program is envisioned as a tool for improving decisions with respect to the selection, acquisition, deployment, use and maintenance of information system resources throughout the DoN.

Recent Publications

Frew, Barry. "Training and Educating IS Professionals to Manage Information Technology in Changing Organizations." Proceedings, SIGCPR 94, Reinventing IS: Managing Information Technology in Changing Organizations (March 1994).

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Research Areas

System Productivity Metrics

Research Description

I am an émigré' from organization theory where I enjoyed a minor reputation for identifying the role-making process in organizations. My IT interests are two-fold. First, I am concerned about the research methods used to assess the productivity of information systems. Secondly, I am drawn to look at the impact of information technology upon work relationships in organizations and upon society and culture at large.

I measured the effectiveness of the SACONS and APADE contract-generation systems by collecting field data on inputs and outputs in a pre- experimental design. I wrote a case study of DOD's consolidation and standardization of information systems through its Corporate Information Management program. I assisted the Office of the Director of Defense Information in developing guidance for DOD managers to undertake business process re-engineering. To this end, I directed the development of the REAP database. I also proposed an automation of the budget forecasting and planning module of the Navy Bureau of Medicine's executive information system.

I recently helped Fleet Numerical Meterology and Oceanographic Center experiment with focus groups as a means to assess system effectiveness from their customers' perspective.

Relevance to DoD/DoN

My work has helped DoD organizations considering off-the-shelf software for the automation of small purchases and contracts. I have directly assisted the Office of the Director of Defense Information in developing a database of organizations that are candidates for benchmarking.

Recent Publications

Haga, W. J. and M. Zviran. "Information Systems Effectiveness: Research Designs for Causal Inference." Journal of Information Systems Vol. 4 (July 1994): 141-166.

Haga, W. J. and J. D. Harrigan. "Planning for natural disasters: U.S. DoD Experience." Proceeding of Computer Security International 93, London (October 1993): 19-22.

Haga, W. J. and M. Zviran. "Key Issues In IS Management: The U.S. DoD Perspective." Defense Analysis Vol. 9, No.2 (August 1993):197-210.

Zviran, M. and W. J. Haga. "Question And Answer Passwords: An Empirical Evaluation". The Computer Journal Vol. 35, No. 3 (1993).

Euske, K.J. and W. J. Haga. "Process For Improving Processes: Elements And Issues." Consortium for Advanced Manufacturing International-Cost Management Systems Programs, San Diego (March 1993).

Haga, W. J. and M. Zviran. "Cognitive Passwords: Key to Easy Access Control." Computers and Security Vol. 9 (December 1990): 723-736.

Haga, W. J. and M. Zviran. "Comparison of Password Techniques." Proceedings of Computer Security International 90, London, (October 1990): 285-295.

Henderson, D. R. and W. J. Haga. "How to Account for Inflation When Taking Present Values." Naval Postgraduate School Technical Report, Systems Management Department, NPS-54-90-020 (September 1990).

Haga, W. J. and M. Zviran. "Password Security: An Exploratory Study". Naval Postgraduate School Technical Report, Systems Management Department, NPS-54-90-011 (May 1990).

Zviran, M. and W. J. Haga. "A Comparison of Password Techniques for Multilevel Authentication Mechanisms." Naval Postgraduate School Technical Report, Systems Management Department, NPS-54-90-014 (May 1990).

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Research Areas

Interoperability and Integration of Heterogeneous Databases

Research Description

Interoperability and integration of heterogeneous databases is one of the main challenges facing today's medium and large-size organizations. We are currently pursuing two different approaches to address this problem.

The first approach addresses the theoretical and practical issues associated with building systems that facilitate interoperability and integration of existing systems while preserving their autonomy and considerable investment. Foremost of these issues is the identification and resolution of semantic heterogeneity that exists among these systems. To address that issue, we have developed a comprehensive framework for identifying, classifying, and resolving semantic heterogeneity for different data models.

The second approach investigates methodologies to gradually reverse-engineer old systems into new integrated and cleanly structured systems that follow modern principles of good design, conform with the data and process models of the enterprise, and comply with accepted standards, therefore increasing their ability to share information with other systems in addition to being easily maintained and enhanced.

Relevance to DoD/DoN

One of the main challenges facing DoD/DoN is the proliferation of a large variety of incompatible database

systems and their associated applications. As the number of databases increases, so does the need to interoperate many of those applications and integrate them into an overall strategic information system.

Our work addresses these issues by investigating the theoretical and practical issues involved in building systems to facilitate the interoperation and integration of these systems and by addressing the issue of reverse engineering legacy system into modern systems that facilitate data sharing and integration.

Recent Publications

Kamel, M. N. "Identifying, Classifying, and Resolving Semantic Conflicts in Distributed Heterogeneous Databases: A Case Study." Journal of Database Management Vol. 6, No. 1, (Winter 1995): 20-32.

Ceruti, M. G. and M. N. Kamel. "Semantic Heterogeneity in Database and Data Dictionary Integration for Command and Control Systems." Proceedings of the 11th Annual Department of Defense Database Colloquium, Database'94, San Diego, CA (August 1994): 65-88.

Kamel, N. N., T. Song, and M. N. Kamel. "An Approach for Building and Integrated Environment for Molecular Biology Database," Journal of Distributed and Parallel Databases Vol. 1, No. 3 (July 1993): 303-327.

M. N. Kamel and N. N. Kamel. "The Federated Database Management System: Requirements, Issues and Solutions." Journal of Computer Communications Vol. 15, No. 4 (May 1992): 270-278.

D. K. Hsiao and M. N. Kamel. "Heterogeneous Databases: Proliferations, Issues and Solutions." IEEE Transactions on Knowledge and Data Engineering Vol. 1, No. 1, (March 1989): 45-62.

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Research Areas

Knowledge-Based Support for Systems Development

Research Description

Large scale systems development and maintenance efforts are often hindered because much of the richness of the design process, namely the *design rationale*, involving the deliberations on alternative design decisions is lost in the course of designing and changing such systems. We have developed a model that is geared towards capturing the rationales behind design decisions and using this knowledge to reason about changes in design decisions. The use of this model for representation and reasoning with rationale behind requirements and design decisions will greatly aid the development and maintenance of large scale systems. A major objective of our research is to elevate the process of systems maintenance to the level of specifications and the rationale behind their creation. Development of models and mechanisms to capture and reuse rationale to support various systems development activities is the primary focus of this work.

Development of complex, mission critical systems involves modification, refinement and evolution of initial requirements that lead to design solutions. In order to provide intelligent and useful support to the process of design and maintenance, a formal representation of the linkages between the design solutions, the requirements and their sources is essential. A comprehensive traceability scheme should not only identity traceability linkages to be maintained, but also provide the mechanisms to support use in systems development and maintenance activities. Based on an extensive empirical study of systems development personnel, we have developed several models for requirements traceability.

Relevance to DoD/DoN

Reducing systems development and maintenance costs and improving the quality and reliability of systems are of major concern for the DoD/DoN. Our work focuses on developing models and mechanisms that will help capture knowledge about the systems development process and use this knowledge to support a variety of stakeholders involved in development and maintenance of the system as well as in future projects. Such a reuse of process knowledge is expected to increase systems development and productivity significantly.

Recent Publications

Ramesh, B. and K Sengupta. "REMAP/MM: Multimedia in Decision Support with Design Rationale." Decision Support Systems (November, 1994).

Ramesh, B. and Luqi. "An Intelligent Assistant for Requirements Validation for Embedded Systems." Journal of Systems Integration Vol. 5, No. 2. (1995).

Ramesh, B. et al "Implementing Requirements Traceability." Proceedings of the IEEE International Symposium on Requirements Engineering York, UK (March 1995).

Ramesh, B. and K. Sengupta. "Managing Cognitive and Mixed-Motive Conflicts in Concurrent Engineering." Concurrent Engineering Research and Applications Vol. 2, (1994): 223-236.

Ramesh, B. and V. Dhar. "Representation and Maintenance of Process Knowledge for Large Scale Systems Development." IEEE Expert, Special Series on Knowledge Based Software Engineering (April 1994).

Ramesh, B. and M. Edwards . "Issues in the Development of a Model for Requirements Traceability." In Proceedings of the IEEE International Symposium on Requirements Engineering, San Diego, CA (January 1993).

Ramesh, B. and V. Dhar. "Supporting Systems Development by Capturing Deliberations during Requirements Engineering." IEEE Transactions on Software Engineering (June 1992).

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Research Areas

Software Reliability and Software Metrics

Research Description

Software Reliability

Research was conducted on the feasibility of optimally selecting failure data in order to identify the optimal set of model parameters that would result in maximum predictive accuracy, using the Schneidewind Software Reliability Model as a vehicle for the research. The research showed that significantly improved reliability predictions can be obtained by using a subset of the failure data, based on applying the appropriate criteria, and using the Space Shuttle On-Board software as an example.

Software Metrics

A comprehensive metrics validation methodology was developed that has six validation criteria which support the quality functions: assessment, control and prediction. New criteria were defined and illustrated, including: consistency, discriminative power, tracking and repeatability. It was shown that non-parametric statistical methods play an important role in evaluating metrics against the validity criteria. It was also shown how metrics that have been validated on a current project can be applied on a future project. A non-parametric statistical method was developed for finding the critical (i.e., threshold) values of metrics. Critical values are identified by applying the discriminative power criterion and are applied in quality control to identify potentially low quality software. It was shown how to do a cost sensitivity analysis on the critical values in order to tradeoff the cost of inspection against the cost of software failures. Lastly, it was shown how metrics that have been validated against the criteria discriminative power and tracking can be used in maintenance to: 1) establish quality control objectives; and 2) prioritize software components (e.g., modules) and allocate resources to maintain them.

Relevance to DoD/DoN

As a result of my software reliability research, an enhanced version of the Schneidewind Software Reliability Model was implemented in Version 5 of the Naval Surface Warfare Center (NSWC) SMERFS software reliability tool, which has been acquired by numerous DoD agencies and contractors. In addition, the model is used at NSWC for research in reliability prediction and analysis of the TRIDENT I and II Fire Control Software.

My software metrics research has also been applied by NSWC to validate metrics for quality assurance of the TRIDENT I and II Fire Control Software.

Recent Publications

Schneidewind, Norman F. "Controlling and Predicting the Quality of Space Shuttle Software Using Metrics." Software Quality Journal (1995): 49-68.

Schneidewind, Norman F. "Validating Metrics for Controlling and Predicting the Quality of Space Shuttle Flight Software." IEEE Computer Vol. 27, No. 8, (August, 1994): 50-57.

Schneidewind, Norman F. "Software Reliability Model with Optimal Selection of Failure Data." IEEE Transactions on Software Engineering Vol. 19, No. 11 (November 1993): 1095-1104.

Schneidewind, N. F. and T.W. Keller. "Application of Reliability Models to the Space Shuttle." IEEE Software Vol. 9, No. 4 (July 1992): 28-33.

Schneidewind, Norman F. "Methodology for Validating Software Metrics." IEEE Transactions on Software Engineering, Vol. 18, No. 5 (May 1992): 410-422.

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Research Areas

Decision Making and Decision Support in Dynamic Environments, Computer-Supported Collaborative Work, Multimedia and Intelligent Tutoring Systems

Research Description

My principal research interests are in the cognitive aspects of behavioral decision theory and their application to the design of information systems. Research in this area is driven to two broad goals: to engage in a systematic study of how decisions are made in individual and collaborative situations, and to apply the findings in formulating design principles for decision support systems.

Within the context of these objectives, I have pursued three themes: feedback/feed forward, dynamic decision environments, and collaborative work. My work on feedback and feed forward examines the comparative efficacies of different types of feedback and feed forward mechanisms (particularly cognitive feedback) in improving decision quality. Much of this work has been conducted in dynamic decision environments in the context of individual and collaborative work situations. The research questions have been examined in experimental settings with computer-supported microworlds that incorporate the complexities and sophistication of real-world settings.

My work in multimedia concerns the use of the technology in the development of interactive instructional systems. I am currently examining the feasibility of building systems in domains that require perceptual learning. One such application is in the area of night vision goggles, which are used by aviators for flying at night. Night vision goggles create a representation of the external environment that is dramatically different from that perceived in daylight conditions. Flying in such environments, therefore, requires extensive training. My research in this area entails building a prototype instructional system that incorporates multimedia, night vision imagery, and synthetic visual environments.

Relevance to DoD/DoN

The relevance of my research on dynamic environments to the DoD/DoN lies in the fact that military decision situations tend to be complex, uncertain, and dynamic. Thus, the ability to provide effective decision support is important to performance in such environments.

Recent Publications

Sengupta, K. "Cognitive Feedback in Environments Characterized by Irrelevant Information." OMEGA: International Journal of Management Science Vol. 23 (1995):125-143.

Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck. "The Impact of Reward Structures on Staff Allocations in a Multi-project Software Development Environment." IEEE Transactions on Engineering Management Vol. 41 (1994): 115-125.

Ramesh, B. and K Sengupta. "REMAP/MM: Multimedia in Decision Support with Design Rationale." Decision Support Systems (November, 1994).

Ramesh, B. and K. Sengupta. "Managing Cognitive and Mixed-Motive Conflicts in Concurrent Engineering." Concurrent Engineering Research and Applications Vol. 2 (1994): 223-236.

Abdel-Hamid, T.K. and K. Sengupta. "Software Project Control: An Experimental Investigation of Judgment with Fallible Information." IEEE Transactions on Software Engineering Vol. 19 (June 1993): 603-612.

Sengupta, K. and D. Te'eni. "Cognitive Feedback GDSS: Improving Control and Convergence." MIS Quarterly Vol. 17 (1993): 87-114, .

Sengupta, K. and Abdel-Hamid, T. "Alternative Conceptions of Feedback in Dynamic Environments: An Experimental Investigation." Management Science Vol. 39 (1993): 411-428.

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Research Areas

Telecommunication Systems and Decision Support Systems

Research Description

The dramatic changes in computing technology coupled with increased demands for computing power has led several organizations to shift towards distributed computing systems. Thus, tasks are processed in parallel by several processors under this scenario. One of the major research issues in this area is to optimally balance the workload among several processors. Load balancing can be either static or dynamic. We have proposed improved algorithms for the static load balancing problem where the workload can be distributed in any proportion among the processors. This also serves as a lower bound for cases where the tasks cannot be split among processors. We are currently developing algorithms for the dynamic load balancing problem.

The field of mobile communication networks is another area which is becoming increasingly important. For example, cellular networks, which fall under this category, have been growing at an explosive rate. The objective of this research is to develop optimal policies for configuring cellular networks. In particular, this research will address the following issues: management of existing facilities, investment in expanding existing facilities and configuring new facilities, and the impact of these decisions on the quality of service. It attempts to answer questions such as: What policies are required to effectively manage the network? When is a policy most effective? What are the implications of using one policy over another? It attempts to incorporate the various technical, operating and regulatory constraints in developing the optimal policies. Finally, it examines the implications of using these policies for managerial decision-making.

Relevance to DoD/DoN

The results from the above research can be useful for various agencies of the DoD/DoN in improving the effectiveness of command and control. Modern warfare requires quick deployment of personnel and sophisticated weapon systems. The use of mobile communication systems such as cellular networks enhance the provision of tactical communications to deployed forces who are constantly on the move. By using optimal policies in configuring such networks, it is possible to ensure their cost-effectiveness and maintain the specified quality of service.

Recent Publications

Gavish B. and S. Sridhar. "Economic Aspects of Configuring Cellular Networks." WIRELESS NETWORKS Vol 1, No 1 (Jan.1995).

Gavish, B., J. Gerdes, and S. Sridhar. "CM3, Looking into the Third and Fourth Dimensions of GDSS." INTEGRATION, INFORMATION AND COLLABORATION MODELS. Kluwer Academic Pub. (1994): 269-299.

Gavish, B., and S. Sridhar. "O(n) Algorithms for Load Balancing in Distributed Computing Systems." COMPUTERS AND OPERATIONS RESEARCH Vol. 21, No 3 (1991): 239-248.

Faculty Research Areas

The Information Technology Management Group's current research efforts fall into the following five broad categories:

- *Model Management*

- *Database Management Systems*

- *Decision Support and Expert Systems*

- *Software Engineering and Applications Development*

- *Networks and Communications*

A brief overview of each catgegory is presented below.

Model Management

The role of modeling is central to the understanding of organizations and to the development of information systems that meet the needs of organizations. Models are used in decision making as well as information systems analysis and design. Creating computer-based environments wherein complex models can be easily represented, manipulated, integrated, and understood is an important objective of software engineering and decision support.

Professor Daniel Dolk's academic contributions have been in the design and construction of software environments to support mathematical programming and statistical analysis. This requires the synthesis of many different fields, including database management, artificial intelligence, operations research, cognitive psychology, and software engineering.

His current interests are in object-oriented enterprise modeling, complex adaptive systems, and symbiotic, or active, modeling systems that incorporate neural network, genetic algorithms, and expert system technology to actively assist the user in data exploration as a precursor for building "good" statistical models.

Computer-aided modeling environments, or model management systems, are designed to facilitate the construction, exercise, and management of mathematical models for decision making. Professor Bhargava's research has contributed to the development of modeling environments in a variety of ways; his niche in this field is in the use of formal logic in developing representation and reasoning models for important components of these systems.

Some topics investigated in Professor Bhargava's research involve modeling principles and philosopy, architectures for modeling environments, and system functions that involve qualitative and symbolic reasoning. A chief contribution of his research is the embedded languages technique that provides an architecture for building modeling environments, allows these systems to represent and reason with a variety of qualitative information, and integrates multiple modeling languages.

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Dolk, D.R. and D.J. Kridel. "Modeling Telecommunications Demand Analysis." <u>Interfaces</u> Vol. 23, No. 2 (1993).

Dolk, D.R. and J.E. Kottemann. "Model Integration And A Theory Of Models." <u>Decision Support Systems</u>, Vol. 9 (1993): 51-63.

Dolk, D.R., D.G. Castillo, D.J. Kridel. "GOST: An active modeling system for costing and planning NASA space programs." <u>Journal of Management Information Systems</u> Vol. 6, No. 1 (January 1992).

Bhargava, H.K., R. Krishnan, and P. Piela. "Formalizing the Semantics of ASCEND." <u>Proceedings of the Twenty-Seventh International Conference on System Sciences, Maui, HI</u> (January 1994).

Bhragava, H.K. "Dimensional Analysis in Mathematical Modeling Systems: A Simple Numerical Method." <u>ORSA Journal on Computing</u> Vol. 5, No. 1, (1993): 33-39.

Bhargava, H.K. and S.O. Kimbrough. "Model Management: An Embedded Languages Approach." <u>Decision Support Systems</u> Vol. 10:3, (1993): 277-300.

Bhargava, H.K. and R. Krishnan. "Computer-aided Model Construction." <u>Decision Support Systems</u> Vol. 9: No. 1, (1993): 91-111.

Database Management Systems

Databases and database technology are having a major impact on the growing use of computers. They play a major role in almost every information system technology and all areas where computers are used.

Professor Kamel's main research interest area is the design, implementation, and application of database systems. Specifically, he is interested in data modeling and query languages, data quality, data integrity, object-oriented database systems, integration of databases with decision support and expert systems, and interoperability and integration issues of heterogeneous databases.

The last issue, interoperability and integration of heterogeneous databases, is of particular interest and is the focus of his current research activity. He is pursuing two different approaches to address this problem. The first approach addresses the theoretical and practical issues associated with building systems that facilitate interoperability and integration of existing systems while preserving their autonomy and considerable investment. The second approach investigates methodologies to gradually reverse-engineer old systems into new integrated and cleanly structured systems that follow modern principles of good design, conform with the data and process models of the enterprise, and comply with accepted standards, therefore increasing their ability to share information with other systems in addition to being easily maintained and enhanced.

Kamel, M. N. "Identifying, Classifying, and Resolving Semantic Conflicts in Distributed Heterogeneous Databases: A Case Study." <u>Journal of Database Management</u>, Vol. 6, No. 1, (Winter 1995): 20-32.

Ceruti, M. G. and M. N. Kamel. "Semantic Heterogeneity in Database and Data Dictionary Integration for Command and Control Systems." <u>Proceedings of the 11th Annual Department of Defense Database Colloquium, Database'94, San Diego, CA</u> (August 1994): 65-88.

Kamel, N. N. , T. Song, and M. N. Kamel. "An Approach for Building and Integrated Environment for Molecular Biology Database." <u>Journal of Distributed and Parallel Databases</u> Vol. 1, No. 3, (July 1993): 303-327.

Decision Support and Expert Systems

Decision Support Systems

Computer-based systems to support the various aspects of decision making, including generation of alternatives, their evaluation and choice.

Sridhar's work focuses on group decision support systems to address the challenges of meetings distributed in time and space. A prototype system called the "Computer Mediated Meeting Management" (CM3) has been developed to facilitate group consensus formation and to enhance the group decision making processes.

The CM3 system supports participant anonymity, triggering of new thought processes, group memory providing fully documented meetings, and the ability to support long duration meetings. In addition, it supports dynamic formation of subgroups within meetings. It consists of several modules for question generation, brainstorming, consolidation, voting, ranking and resource allocation

Publications:

Gavish, B., J. Gerdes, and S. Sridhar. "CM3 — A Distributed Group Decision Support System." <u>IIE TRANSACTIONS</u>

Gavish, B., Gerdes, J., and S. Sridhar. "CM3, Looking into the Third and Fourth Dimensions of GDSS." in <u>INTEGRATION, INFORMATION AND COLLABORATION MODELS</u>, Kluwer Academic Pub., 1994, 269-299.

Decision Making in Dynamic Environments

Research in dynamic decision environments is motivated by the recognition that many decision situations (such as combat decision making) are dynamic in nature. Research in this area is typically carried out with three objectives:

- Ascertain how individuals and groups cope with complex dynamic environments,

- Design appropriate organizational structures to facilitate adaptation by teams in such environments, and

- Establish design principles for building decision support systems for dynamic environments.

Professor Kishore Sengupta's contribution in this area has been in expanding our understanding of how individuals and groups make decisions in such environments, and in establishing the comparative efficacies of different feedback and feedforward mechanisms in dynamic environments. He is currently examining the question of adaptive coordination in the context of an ONR-funded project on flexible organizations.

Publications:

Sengupta, K. and T. Abdel-Hamid. "Alternative Conceptions of Feedback in Dynamic Environments: An experimental Investigation." <u>Management Science,</u> Vol. 39,(1993): 411-428.

Abdel-Hamid, T., K. Sengupta, and D. Ronan. "Software Project Control: An Experimental Investigation of Judgment under Fallible Information." IEEE Transactions on Software Engineering, Vol. 19, (1993): 603-612.

Sengupta, K. "Cognitive Feedback in Environments Characterized by Irrelevant Information." OMEGA: International Journal of Management Science, Vol. 23 (1995): 125-143.

Sengupta, K., C. Jones, and B. Wright. "Adding Intelligence to Simulators for Distributed Decision Making." Proceedings of the JDL Symposium on Command and Control, Monterey, CA.

Instructional Multimedia Systems

Instructional multimedia systems offer the potential of engendering fundamental changes in the way we learn. The design of effective instructional systems thus carries important implications for training and education in the workplace. The objective of this project is to develop and evaluate interactive multimedia systems for instruction in complex tasks.

Professor Kishore Sengupta's contribution to this project has been primarily in the design and construction of multimedia systems for instruction. Much of this work has been conducted in the context of training for night vision goggles. Night vision goggles are being used widely by aviators for flying in night time and low light conditions. Such goggles are used for a wide variety of tasks, ranging from combat missions to medical evacuation procedures. The representation of the external world offered by night vision goggles is dramatically different from normal (daylight) perception. Thus, without adequate training in the use of these goggles, even otherwise experienced aviators are prone to committing errors that would not normally occur in daylight conditions. In the absence of suitable training mechanisms, the increasing use of night vision goggles has been accompanied by a dramatic rise in accident rates.

As part of a multi-year project funded by the Naval Air Systems Command, Professor Sengupta is building a hypermedia instructional system that will enable aviators to learn critical perceptual skills required for the effective use of night vision goggles. The system will provide self-paced instruction, along with practice and rehearsal sessions. The system will also evaluate students on their progress.

Publications:

Ciavarelli, A., K. Sengupta, and W. Baer. "Night Vision Goggle Training Technology." Technical Report, Naval Postgraduate School, Monterey, CA, (1994).

SOFTWARE ENGINEERING AND APPLICATIONS DEVELOPMENT

Software Engineering and Project Management

Professor Abdel-Hamid has focused on applying the system dynamics modeling technique to study the dynamics of software project management. This has led to the development of a hierarchy of interrelated models to study single-project dynamics, multi-project dynamics (e.g., multiple projects sharing common resources), and organization-wide dynamics (e.g., impacts of organization-wide policies for software reuse). Through modeling and simulation, these models serve as "experimentation laboratories" to study software project management phenomena and gain a better understanding of the dynamically complex interactions and trade-offs that characterize software project management.

Professor Abdel-Hamid is also working on the development of "intelligent" tutoring interfaces to the system dynamics models of software project management in order to use them as "learning laboratories" for software project managers. (This is analogous to the use of flight simulators in training pilots.)

Publications:

Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck. "The Effect of Reward Structures on Allocating Shared Staff Resources Among Interdependent Software Projects: An Experimaental Investigation." IEEE Transactions on Engineering Management Vol.41, No. 2, (May 1994): 115-125.

Abdel-Hamid, T.K. and Sengupta, K. "Software Project Control: An Experimental Investigation of Judgment with Fallible Information." IEEE Transactions on Software Engineering (June 1993): 603-612.

Sengupta, K. and Abdel-Hamid, T.K. "An Investigation of Alternative Feedback Strategies in Dynamic Decision Making." Management Science (April 1993): 411-428.

Abdel-Hamid, T.K. "Adapting, Correcting, and Perfecting Software Estimates: A maintenance Metaphor." Computer (March 1993): 20-29.

Abdel-Hamid, T.K. and Madnick, S.E. Software Project Dynamics: An Integrated Approach. New York: Prentice-Hall, 1991.

Software Reliability

Since software process and product evolve over time, software reliability models should be designed to selectively use failure data to reflect this fact. To meet this need, a software reliability model with optimal selection of failure data was developed.

Professor Schneidewind has developed a software reliability model that is used by LORAL Space Information Systems and NASA at the Johnson Space Center in Houston to assist in making reliability predictions of the Space Shuttle flight software. The model predicts time to next failure and remaining failures to help assure the flight worthiness of the Shuttle software. These predictions, along with many other quality assurance techniques, provide confidence prior to launch that there will be no critical (i.e., loss of life or mission) software failures during a Shuttle mission.

This model is one of only four models recommended by the American National Standards Institute/American Institute of Aeronautics and Astronautics Recommended Practice for Software Reliability. The Schneidewind model is also one of the models included in the Statistical Modeling and Estimation of Reliability Functions for Software (SMERFS) tool, developed by the Naval Surface Warfare Center, which has been acquired by hundreds of government, industrial, and academic organizations.

For the development of this model and other contributions to software measuremnt, Dr. Schneidewind was elected a Fellow of the Institute of Electrical and Electronics Engineers in 1992.

Publications:

Schneidewind, Norman F. "Validating Metrics for Controlling and Predicting the Quality of Space Shuttle Flight Software", IEEE Computer Vol. 27, No. 8 (August, 1994): 50-57.

Schneidewind, Norman F. "Software Reliability Model with Optimal Selection of Failure Data." IEEE Transactions on Software Engineering, Vol. 19, No. 11, (November 1993): 1095-1104.

Schneidewind, Norman F. and T.W. Keller. "Application of Reliability Models to the Space Shuttle." IEEE Software, Vol. 9, No. 4, (July 1992): 28-33.

Schneidewind, Norman F. "Methodology for Validating Software Metrics." IEEE Transactions on Software Engineering. Vol. 18, No. 5, (May 1992): 410-422.

Software Metrics

The measurement of the productivity of information systems is a critical element in the legitimation, funding and development of information technology. The attraction of convenient surrogate metrics for productivity raises the possibility that the management and support structure for information technology, although not the technology itself, may drift into irrelevance. Developing metrics of system productivity that are validated with behavioral anchors or employ non-obtrusive instrumentation is essential to gaining support for information technology from increasingly skeptical decision makers in the top levels of management.

Professor William Haga's research efforts have included the measurement of the effectiveness of the SACONS and APADE contract-generation systems through the collection of field data on inputs and outputs in a pre- experimental design. He has assisted the Office of the Director of Defense Information in developing guidance for DOD managers who undertake business process re-engineering. To this end, he directed the development of the REAP database. He also proposed an automation of the budget forecasting and planning module of the Navy Bureau of Medicine's executive information system.

His emerging interest is in examining the impact of information technology upon work relationships in organizations and upon society and culture at large.

Publications:

Haga, W J and M Zviran. "Information Systems Effectiveness: Research Designs for Causal Inference." Journal of Information Systems, Vol. 4 (July 1994): 141-166.

Euske, K J and W J Haga. "Process for Improving Processes: Elements and Issues." Consortium for Advanced Manufacturing International-Cost Management Systems Program, San Diego, (March 1993).

Haga, W J and M Zviran. "Key Issues In IS Management: The U.S. DoD Perspective." Defense Analysis, Vol. 9, No. 2 (August 1993): 197-210.

Application Development

Application development is concerned with the translation of information systems requirements into a working system that satisfies the requirements.

Professor Emery's recent research has focused on the problem of developing application software. The conventional software development process — employing a multi-phased structured design process and writing custom programs in a procedural language — has led to frequent budget and schedule overruns and systems that often do not meet the changing needs of users.

A variety of new approaches to application development appear to offer substantial potential for improving the process. Included are the use of application packages, templates, reusable objects and components, "middleware" products to integrate components, and "4th generation languages."

Professors Emery and Frew are studying various approaches to integrating and interconnecting applications to increase the efficiency and effectiveness of enterprise-wide information management support. The intent is to develop real applications for real use at NPS, because the school is viewed as a microcosm of DoN/DoD's information environment. A wide spectrum of technical approaches is being used, including the implementation of Commercial-Off-The-Shelf (COTS) products for client/server use of work-group, work-flow products for document management and fourth generation (4GL) application development tools. The strategy is to use DoD processes and standards in building interoperable applications in order to develop a model for wider use within DoD/DoN.

Publications:

Emery, James C. and Dani Zweig. "The Use of Ada for the Implementation of Automated Information Systems within the Department of Defense." Naval Postgraduate School (December 1993): 33.

Emery, James C. "The Strategic Implications of a Productive Software Development Process." Proceedings of the Workshop on Information Technologies and Systems, M.I.T. (December 1991): 15.

Emery, James C. "ADA and Management Information Systems: Policy Issues Concerning Programming Language Options for the Department of Defense." Naval Postgraduate School, Monterey, CA, (June 1991):102.

Emery, James C. Organizational Planning and Control Systems: Theory and Technology, Macmillan, (1969).

NETWORKS AND COMMUNICATIONS

Distributed Systems and Computer Networks

A paradigm has been developed for the system and software design of distributed systems, with application to large scale computer networks consisting of local area networks interconnected by a wide area network.

Professor Schneidewind has developed a paradigm for the system and software design of distributed systems with application to the Navy's Stock Point Logistics Integrated Communications Environment (SPLICE), which is a distributed computer network for providing high speed logistics transaction processing to support the Navy's world-wide material requirements. The system consists of local computer networks and an interconnecting wide area network, the Defense Data Network.

A number of design principles are offered with particular reference to how they can be applied to the design of distributed systems. The major contribution to the field of distributed systems is an explanation of how to make design decisions about distributed systems in a way that will enhance maintainability and understandability of the software and, at the same time, result in good system performance. An additional objective is to recognize the implications for software quality of various decisions which must be made in the process of specifying a distributed system.

Publications:

Schneidewind, Norman F. "Interconnecting Local Networks to Long-Distance Networks." IEEE Computer, Vol. 16, No. 9, (September 1983): 15-24.

Schneidewind, Norman F. "Distributed System Software Design Paradigm with Application to Computer Networks." IEEE Transactions on Software Engineering, Vol. 15, No. 4, (April 1989): 402-412.

Telecommunication Systems

Professor Sridhar is interested in the use of quantitative and qualitative tools for modeling, analysis, design and management of telecommunication systems.

Sridhar has developed algorithms for optimally balancing a given workload among processors with preassigned loads, in a distributed computing system. The processors may either have equal or unequal processing rates. The analysis considers the case where perfect load balancing is possible, as well as the case where only approximate load balancing is possible.

His current research focuses on the economic aspects of configuring cellular networks. A model has been developed to determine the system configuration which will maximize the annual expected net revenues. The study includes an analysis of the impact of changes in design parameters on system configuration, the cost of competition, and its implications for the regulatory agency.

Publications:

Gavish, B., and S. Sridhar. "O(n) Algorithms for Load Balancing in Distributed Computing Systems." COMPUTERS AND OPERATIONS RESEARCH, Vol. 21(3), (1991): 239-248.

Gavish, B., and S. Sridhar, "Economic Aspects of Configuring Cellular Networks," WIRELESS NETWORKS, Vol.1(1), (1995): 115-128.

Research Centers And Laboratories

There are three centers/laboratories:

- *Decision and Information Systems Research Center*

- *Multimedia Research Laboratory*

- *Software Metrics Research Center*

A brief overview of each center/laboratory follows.

DECISION AND INFORMATION SYSTEMS RESEARCH CENTER

The Decision and Information Systems Research Center (DISC) was established at the Naval Postgraduate School in 1995. Its research focus is on the design, implementation, and analysis of information systems directed at organizational computing and decision making. The Center currently has 12 associated faculty, representing backgrounds and research interests in decision sciences, software development, networking, and interoperability and integration of information technologies and modeling methodologies. DISC provides a common identity for related research projects as well as various support services. The Center runs an active seminar series drawing speakers from various universities, industry, DoD organizations and research laboratories.

DISC faculty research is sponsored by a broad range of funding agencies, including several in the Department of Defense. Current topics being researched by the Center's faculty include:

- *The use of the internet for sharing decision-oriented information technologies*

- *Development of multimedia-capable intelligent-tutoring technologies*

- *Evolutionary computing*

- *Investigation of new paradigms for developing organizational computing software*

- *Development of guidelines for the migration to an integrated and interoperable client-server architecture*

Further information about the Center is available via the World Wide Web (http://sm.nps.navy.mil/DISC/disc.html), via electronic mail (disc@sm.nps.navy.mil), or by calling the Professor Hemant Bhargava at (408) 656-2264.

MULTIMEDIA RESEARCH LABORATORY

The objective of the effort is to provide a vehicle for conducting interdisciplinary research on instructional technology and in information systems that utilize evolving multimedia technologies. The facility has been in existence since 1992 and is used by faculty and students from the Information Systems, Aviation Safety, and Command & Control areas. The laboratory provides multimedia

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computing facilities for two platforms: MS-DOS/Windows based and UNIX based systems. Currently, we have a network of Sun workstations as well as high-end MS-DOS-based machines.

The faculty and students involved with the laboratory are pursuing research on a variety of topics, much of it in cooperation with different units of the Navy and other services. Principal areas of research include:

- *Development of a prototype computer-based system for training on night vision goggles*

- *Application of Multimedia for Capturing Design Rationale*

- *Design and Implementation of an Expert Advisor for Maintenance of the Mark-92 Fire Control System*

- *Development of Interactive Education Media*

For further information, contact Professor Sengupta, Director of the Multimedia Research Laboratory at Phone: (408) 656-3212 or via E-mail: kishore@nps.navy.mil

SOFTWARE METRICS RESEARCH CENTER

Increasingly, DoD is requiring the use of metrics in software development contracts. Although there have been significant achievements in this area, there exists gaps in theory and practice. Among these are validation methodologies, process methodologies, databases, metrics tools, and cost analyses. The Software Metrics Research Center was established in response to DoD needs to address these issues. Here students and faculty tackle such issues as integration of metrics methodology into the software life-cycle process, development of metrics tools, and general metrics research. Current research projects include:

- *Space Shuttle Software Reliability and Metrics*

- *A Software Reliability Model with Optimal Selection of Failure Data*

For further information, contact Professor Schneidewind, Director of the Software Metrics Research Center at Phone: (408) 656-2719 or via E-mail: Schneidewind@nps.navy.mil

Recent Research Sponsors

Army Artificial Intelligence Center

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Naval Surface Warfare Center -Port Hueneme Division

Office of Naval Research (ONR)

Pacific Bell

Swiss National Foundation for Scientific Research

Recent Publications

1995 Publications

IT95.1 Gavish, B. and S. Sridhar. "Economic Aspects of Configuring Cellular Networks." WIRELESS NETWORKS Vol. 1, No. 1, (Jan.1995).

IT95.2 Sengupta, K. "Cognitive Feedback in Environments Characterized by Irrelevant Information." OMEGA: International Journal of Management Science Vol. 23 (1995): 411- 428.

IT95.3 Ramesh, B. "An Intelligent Assistant for Requirements Validation for embedded systems." Journal of Systems Integration Vol. 5, No. 2. (1995).

IT95.4 Ramesh, B. et al "Implementing Requirements Traceability." Proceedings of the IEEE International Symposium on Requirements Engineering York, UK (March 1995).

IT95.5 Kamel, M. N. "Identifying, Classifying, and Resolving Semantic Conflicts in Distributed Heterogeneous Databases: A Case Study." Journal of Database Management Vol. 6, No. 1, (Winter 1995): 20-32.

IT95.6 Binbasioglu, T. Bui, and Ma. "An Action-Resource Language for Argumentation: The Case of Softwood Lumber Negotiation." 28th Hawaii International Conference in System Sciences (January 1995).

1994 Publications

IT94.1 Ceruti, M. G. and M. N. Kamel. "Semantic Heterogeneity in Database and Data Dictionary Integration for Command and Control Systems." Proceedings of the 11th Annual Department of Defense Database Colloquium, Database'94, San Diego, CA (August 1994): 65-88.

IT94.2 Ramesh, B. and K. Sengupta . "Managing Cognitive and Mixed-Motive Conflicts." Concurrent Engineering Research and Applications Vol. 2, (1994): 223-236.

IT94.3 Sengupta, K., D. Te'eni, N. Melone, M. Limayen, and S. Weisband. "Views of Work and the Design and Use of Group Support Systems." Accounting, Management, and Information Technology Vol. 4, No. 4, (1994): 245-266.

IT94.4 Ramesh, B. and V. Dhar . "Representation and Maintenance of Process Knowledge for Large Scale Systems Development." IEEE Expert, Special Series on Knowledge Based Software Engineering (April 1994).

IT94.5 Schneidewind, Norman F. "Validating Metrics for Controlling and Predicting the Quality of Space Shuttle Flight Software." IEEE Computer Vol. 27, No. 8, (August, 1994): 50-57.

IT94.6 Bhargava, H.K., R. Krishnan, and A.B. Whinston. "On Integrating Modeling and Collaborative Technologies." Journal of Organizational Computing Vol. 4, No. 3 (1994).

IT94.7 Dolk, D.R. and K. J. Euske. "Model integration: Overcoming the stovepipe organization." Advances in Management Accounting Vol. 3. M.J. Epstein and K.M. Poston (Eds),. JAI Press, Inc., (1994).

IT94.8 Gavish, B., J. Gerdes, and S. Sridhar. "CM3, Looking into the Third and Fourth Dimensions of GDSS." INTEGRATION, INFORMATION AND COLLABORATION MODELS. Kluwer Academic Pub. (1994): 269-299.

IT94.9 Emery, J. C. Report of the Committee on Computing. Naval Postgraduate School, Monterey, CA, (July 1994): 32.

IT94.10 Frew, Barry. "Training and Educating IS Professionals to Manage Information Technology in Changing Organizations." Proceedings, SIGCPR 94, Reinventing IS: Managing Information Technology in Changing Organizations "March 1994).

IT94.11 Haga, W. J. and M. Zviran. "Information Systems Effectiveness: Research Designs for Causal Inference." Journal of Information Systems Vol. 4 (July 1994): 141-166.

IT94.12 Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck. "The Effect of Reward Structures on Allocating Shared Staff Resources Among Interdependent Software Projects: An Experimaental Investigation." IEEE Transactions on Engineering Management Vol. 41, No. 2, (May 1994):115-125.

IT94.13 Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck. "The Impact of Reward Structures on Staff Allocations in a Multi-project Software Development Environment." IEEE Transactions on Engineering Management Vol. 41 (1994).

IT94.14 Ramesh, B., and K Sengupta. "REMAP/MM: Multimedia in Decision Support with Design Rationale." Decision Support Systems (November, 1994).

IT94.15 Ramesh, B., and K. Sengupta. "Managing Cognitive and Mixed-Motive Conflicts in Concurrent Engineering." Concurrent Engineering Research and Applications Vol. 2, (1994): 223-236.

IT94.16 Bui, Tung and Mak. "An Empirical of Neural Networks in Strategic Decision Making." Proceedings of WITS Vancouver (December 1994).

IT94.17 Bui, Tung and Petrazzini. "Vietnam: Rapid Growth and Cautious Reform." Telecommunications Journal (October 1994).

IT94.18 Bui,Tung and Mak. "Modeling Expert's Knowledge: The New Product Entry Problem." IEEE Conference of Software Engineering, Austin, Texas (April 1994).

IT94.19 Bui, T. "Evaluating Negotiation Support Systems: A Conceptualization." 27th Hawaii International Conference in System Sciences Vol. III (January 1994).

1993 Publications

IT93.1 Abdel-Hamid, T., K Sengupta, and D. Ronan. "Software Project Control: An Experimental Investigation of Judgment under Fallible Information." IEEE Transactions on Software Engineering Vol. 19 (June 1993) 603-612.

IT93.2 Sengupta, K. and D. Te'eni. "Cognitive Feedback GDSS: Improving Control and Convergence." MIS Quarterly Vol. 17 (1993): 87-114, .

IT93.3 Sengupta, K. and Abdel-Hamid, T. "Alternative Conceptions of Feedback in Dynamic Environments: An Experimental Investigation." Management Science Vol. 39 (April 1993): 411-428.

IT93.7 Abdel-Hamid, T.K. "Adapting, Correcting, and Perfecting Software Estimates: A maintenance Metaphor." Computer (March 1993): 20-29.

IT93.8 Haga, W. J. and J. D. Harrigan. "Planning for natural disasters: U.S. DoD Experience." Proceeding of Computer Security International 93, London (October 1993): 19-22.

IT93.9 Haga, W. J. and M. Zviran. "Key Issues In IS Management: The U.S. DoD Perspective." Defense Analysis Vol. 9, No. 2 (August 1993):197-210.

IT93.10 Zviran, M. and W. J. Haga. "Question And Answer Passwords: An Empirical Evaluation". The Computer Journal Vol. 35, No. 3 (1993).

IT93.11 Euske, K.J. and W. J. Haga. "Process For Improving Processes: Elements And Issues." Consortium for Advanced Manufacturing International-Cost Management Systems Programs, San Diego (March 1993).

IT93.12 Schneidewind, Norman F. "Software Reliability Model with Optimal Selection of Failure Data." IEEE Transactions on Software Engineering Vol. 19, No. 11 (November 1993): 1095-1104.

IT93.13 Bhargava, H. K. and S.O. Kimbrough. "Model Management: An Embedded Languages Approach." Decision Support Systems Vol. 10, No. 3 (1993): 277—300.

IT93.14 Bhargava, H. K., "Dimensional Analysis in Mathematical Modeling Systems: A Simple Numerical Method." ORSA Journal on Computing Vol. 5, No. 1 (1993): 33—39.

IT93.15 Bhargava, H. K, and R. Krishnan. "Computer-aided Model Construction." Decision Support Systems Vol. 9, No. 1 (1993): 91—111.

IT93.16 Buddenberg, Rex. "Computer Networking and C3I Systems for Emergency Services." (1993). Available on ftp.nps.navy.mil in pub/sm/budden/text_word or ~/text_wp and on http://vislab-www.nps.navy.mil/~budden.

IT93.17 Dolk, D.R. and Kottemann, J.E. "Model integration and a Theory of Models." Decision Support Systems Vol. 9 (1993): 51-63.

IT93.18 Emery, James C. and Dani Zweig. "The Use of Ada for the Implementation of Automated Information Systems within the Department of Defense." Naval Postgraduate School (December 1993): 33.

IT93.19 Kamel, N. N., T. Song, and M. N. Kamel, "An Approach for Building and Integrated Environment for Molecular Biology Database," Journal of Distributed and Parallel Databases Vol. 1, No. 3 (July 1993): 303-327.

IT93.20 Emery, James C. "The Global Organization as the Norm." Journal of Global Information Management Vol. 1, No. 3 (Summer 1993):3-4, 31, 44.

IT93.21 Ramesh, B. and M. Edwards . "Issues in the Development of a Model for Requirements Traceability." In Proceedings of the IEEE International Symposium on Requirements Engineering, San Diego, CA. (January 1993).

IT93.22 Bui, T. and Strand. "A Neural Net Model to Represent Negotiators' Heuristics." 25th Hawaii International Conference in System Sciences Vol. III (January 1993).

IT93.23 Bui, Tung. "A Neural-Network Based Behavioral Theory of Tank Commanders, Neural Network Research for Military Applications." (Jules Borack, Ed.), Book Chapter, NPRDC, San Diego, (1993).

IT93.24 Bui, T, "Designing Multiple Criteria Negotiation Support Systems: Framework and Issues." Book Chapter, Multiple Criteria Decision Making: Expand and enrich the Domains of Thinking and Applications (Tzeng et al., Eds), Springer Verlag. (December 1993).

1992 Publications

IT92.1 Schneidewind, N. F. and T.W. Keller. "Application of Reliability Models to the Space Shuttle." IEEE Software Vol. 9, No. 4 (July 1992): 28-33.

IT92.2 Ramesh, B. and V. Dhar. "Supporting Systems Development by Capturing Deliberations during Requirements Engineering." IEEE Transactions on Software Engineering (June 1992).

IT92.3 Bui, T. and Sivasankaran. "A Stochastic Model of Organizational Choice." Belgium Journal of Operations Research, Statistics and Computer Science Vol. 31, No. 3-4 (1992).

IT92.4 Bhargava, H. K., R. Krishnan, and S. Mukherjee. "On the Integration of Algebraic and Data Modeling Languages." Annals of Operations Research Vol. 38 (1992): 69-95.

IT92.5 Emery, James C., Tung X. Bui and Cheryl D. Blake. "Prototyping with Application Generators: Lessons Learned from the Naval Aviation Logistics Command Management Information System Case." Naval Postgraduate School (October 1992): 56.

IT92.6 Dolk, D.R., D.G. Castillo, D.J Kridel. "GOST: An active modeling system for costing and planning NASA space programs." Journal of Management Information Systems Vol. 6, No. 1 (January 1992).

IT92.7 Emery, James C. "Downsizing the Enterprise." SIM Network Vol. 7, No.1 (Jan-Feb 1992).

IT92.8 M. N. Kamel and N. N. Kamel. "The Federated Database Management System: Requirements, Issues and Solutions." Journal of Computer Communications Vol. 15, No. 4 (May 1992): 270-278.

IT94.9 Schneidewind, Norman F. "Methodology for Validating Software Metrics." IEEE Transactions on Software Engineerin, Vol. 18, No. 5 (May 1992): 410-422.

1991 Publications

IT91.1 Gavish, B., and S. Sridhar. "O(n) Algorithms for Load Balancing in Distributed Computing Systems." COMPUTERS AND OPERATIONS RESEARCH Vol. 21, No. 3 (1991): 239-248.

IT91.2 Emery, James C. "The Strategic Implications of a Productive Software Development Process." Proceedings of the Workshop on Information Technologies and Systems, M.I.T. (December 1991): 15.

IT91.3 Emery, James C. "ADA and Management Information Systems: Policy Issues Concerning Programming Language Options for the Department of Defense." Naval Postgraduate School, Monterey, CA, (June 1991): 102.

IT91.4 H.K. Bhargava, S.O. Kimbrough, and R. Krishnan. "Unique Names Violations, a Problem for Model Integration or You Say Tomato, I Say Tomahto." ORSA Journal on Computing Vol. 3, No. 2 (Spring 1991): 107-120.

IT91.5 Dolk, D.R. and D.J. Kridel. "An Active Modeling System for Econometric Analysis." Decision Support Systems, Vol. 7 (1991).

IT91.6 Abdel-Hamid, T.K. and S.E. Madnick. "Software Project Dynamics: An Integrated Approach." New York: Prentice-Hall, (1991).

IT91.7 Haga, W. J. and M. Zviran. "The Practice of Password Usage: Some Empirical Evidence." <u>Proceedings of the Seventh Inter-national Conference on Information Security, Brighton</u> (May 1991).

1990 Publications

IT90.1 Haga, W. J. and M. Zviran. "Cognitive Passwords: Key to Easy Access Control." <u>Computers and Security</u> Vol. 9 (December 1990): 723-736.

IT90.2 Emery, James C. "The Strategic Role of Information Systems." <u>Journal of Academy of Management Information, Japan,</u> Vol. 1, No. 1 (Nov 1990): 55-82.

IT90.3 Haga, W. J. and M. Zviran. "Comparison of Password Techniques." <u>Proceedings of Computer Security International 90, London,</u> (October 1990).

IT90.4 Zviran, M. and W. J. Haga. "User Authentication by Cognitive Passwords." <u>Proceedings of the Fifth Jerusalem Conference on Information Technology</u> (October 1990).

IT90.5 Henderson, D. R. and W. J. Haga. "How to Account for Inflation When Taking Present Values." <u>Naval Postgraduate School Technical Report, Systems Management Department</u>, NPS-54-90-020, (September 1990).

IT90.6 Haga, W. J. and M. Zviran. "Password Security: An Exploratory Study". <u>Naval Postgraduate School Technical Report, Systems Management Department,</u> NPS-54-90-011, (May 1990).

IT90.7 Zviran, M. and W. J. Haga. "A Comparison of Password Techniques for Multilevel Authentication Mechanisms." <u>Naval Postgraduate School Technical Report, Systems Management Department,</u> NPS-54-90-014.

APPENDIX D.   ELECTRONIC PAGE DESIGNS

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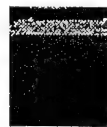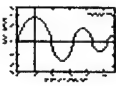
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
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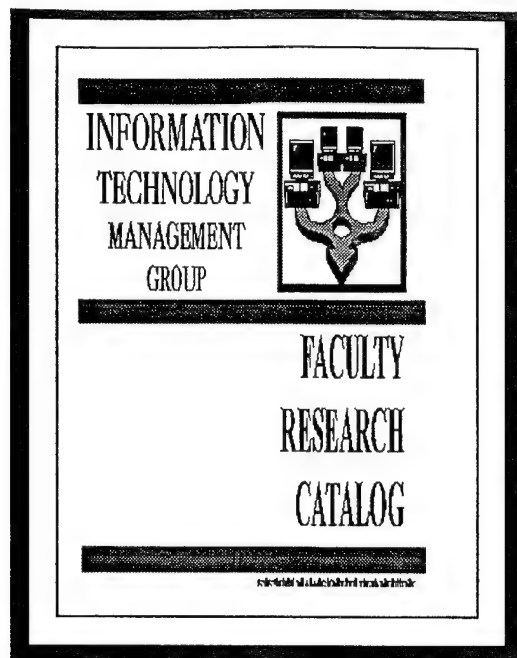
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Letter from the Chairman
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Message from the Chair

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Welcome! I want to introduce you to the Department of Systems Management at the Naval Postgraduate School. Our department has the largest and most diverse faculty and student body at the Naval Postgraduate School. We have eleven different curricula, ranging from financial management to acquisition and contract management to information technology management. With over seventy full-time faculty and more than 500 graduate students, we proudly claim to be DoD s premier Graduate School of Management .

This brochure is one of our ways of establishing closer connection with our customers present and future who are interested in Information Systems, one of our core areas of expertise. Over the past six years we ve built one of the best information systems faculties in the world. The purpose of this brochure is to describe the faculty their accomplishments, capabilities, and aspirations and to showcase their achievements that have impactfully addressed a range of DoD s recent and current problems. To be sure, this group of professionals is impressive both in terms of their educational preparation and their demonstrated commitment to advancing the frontiers of this important field.

As you peruse the following pages, I m confident that you ll be as impressed with the achievements and potential of our faculty and their graduate student advisees as I ve been these past few years. As you skim through the narratives that describe my colleagues interests and capabilities or as you review the summaries of our collective areas of expertise, I m sure you ll conclude that we offer a research and studies-and-analysis capability that is difficult to replicate.

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Give me a call if you d like further information on the Department of Systems Management and our abilities to assist you.

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Overview

We are rapidly moving from an era of information scarcity to one of abundance. Until very recently, information technology was expensive, time consuming, and error prone; by historical standards, it is now cheap, fast, and reliable.

Because of these changes, the use of information technology often offers the most attractive means of increasing an organization s effectiveness and reducing its use of capital resources and personnel. The changes have been so profound that it is becoming common to regard the new era as the Information Age, in which information technology in all its forms becomes a fundamental determinant of a nation s or organization s ability to thrive in the Nineties and beyond.

The importance of information technology is, of course, widely recognized in the Navy and Department of Defense. For many technical, economic, demographic, and political reasons, the U.S. must emphasize improved quality rather than quantity in its military force structure. Applications of computer technology provide one of the important avenues for achieving such quality. This is manifested in the growing proliferation and power of smart weapons. Information technology is important not only in weapons systems; it is also an essential ingredient in improved command and control systems. Success in C2 warfare and C4I for the warrior is totally dependent on wisely deployed information technology. Any fundamental improvements in the efficiency and effectiveness of managing the military services for example, in logistics, human resource management, and financial control will almost certainly require the use of computer-based systems.

The most recent Defense Critical Technologies Plan selects 20 areas of technology that are regarded as the most critical in supporting the military needs of the United States. Information technology is a direct or indirect ingredient of almost all of these critical areas. Because of its leadership role in many aspects of information technology, the U.S. has gained an advantage compared to its potential military adversaries.

The Information Technology Management (ITM) group of the Systems Management Department of the Naval Postgraduate School consists of 13 faculty members. The masters program in ITM typical has an enrollment of about 100 students at a given point in time.

An important distinguishing characteristic of the faculty is its focus on the application of computer-based systems, especially in DoN/DoD environments. Although their work frequently involves advanced technology, it is not only advances in technology that motivate the teaching and research of the group. It is, rather, the understanding of existing technology and the development of new technology that potentially makes it possible to develop more efficient and effective information systems within the DoN/DoD context.

The ITM group provides a unique resource within the DoD. Its well-recognized competence and wide range of interests equips the group to provide assistance to DoN and DoD agencies in several ways. These can be broken down into 1) research, 2) prototype systems development, and 3) executive education.

Research. In order to tackle the increasingly difficult challenges of implementing effective information systems, management in the private sector as well as the DoD and other government agencies needs to gain a better understanding of the issues. The unique character and scale of the DoD makes it especially difficult to implement successful systems. There is a lot that we do not know about how systems can be made more effective, how we can develop them more quickly and cheaply, and how we can cope with the organizational changes required. The research being conducted by the ITM group is aimed at dealing with such questions.

The ITM group is well qualified to engage in multi-disciplinary research aimed at dealing with difficult problems recognized as important by the leadership of a DoN or DoD agency. The group is most effective in dealing with challenging research tasks that require deep technical competence, viewpoints drawn from multiple disciplines, and effort spread over a number of months or even a few years. Faculty members are motivated to publish the results of their research as contributions to technical and management literature.

Prototype systems development. Working as they do in an applied area, faculty members are generally interested in seeing their work put into practice. Although faculty members usually do not have the time to develop full-scale production systems, they can play a valuable role in assisting in the development of prototype systems that demonstrate and verify concepts. Contemporary application development tools particularly those available on microcomputers make it feasible to undertake significant development projects. Once a concept has been demonstrated as practical and useful, it is then generally possible for an appropriate technical group to translate the concept into a working production system.

The graduate students at NPS provide a valuable resource for doing such prototype

developments. They are typically quite experienced in DoD matters, and have been well trained in information technology. Furthermore, they have received the kind of breadth in related areas such as management, economics, accounting, etc, required to deal effectively with real world problems. Each student is required to perform a research project and write a thesis that represents a significant piece of work. A prototype project of the type envisioned here serves as an ideal source of thesis topics. Working closely with one or more faculty members, a highly professional team of students can be assembled to deal with important ITM topics.

Executive education. It is becoming increasingly well recognized that one of the critical success factors in applying information technology is to obtain executive leadership. The technical staff can be held responsible for developing good technical solutions, but the task of translating organizational needs into information systems specifications must come from the top leaders. That is the role for general management.

In order to play that role effectively, an executive should know something about the technology and how it can serve the needs of the organization. Such a leader need not should not be concerned with strictly technical matters. He or she does, however, need to know the strengths and weaknesses of information systems, have a reasonable appreciation for the difficulty of implementing a system, and understand the tradeoffs involved in balancing the costs and benefits of a proposed system.

The ITM group is well qualified to develop and present tailored executive education programs. It has wide experience in teaching in a variety of environments. Its special familiarity with DoN and DoD matters permits the group to use relevant and appropriate examples and case materials. It has the resources including graduate students seeking interesting thesis topics to develop tailored material for a particular DoD audience.

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- Hemant K. Bhargava Assistant Professor of Information Systems
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- Tung X. Bui Professor of Information Systems
- Daniel R. Dolk Professor of Information Systems
- James Emery Professor of Information Systems
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- William J. Haga Senior Lecturer
- Magdi Kamel Associate Professor of Information Systems
- Martin J. McCaffrey Visiting Assistant Professor of Information Systems and Acquisition and Contract Management
- Balasubramaniam Ramesh Assistant Professor of Information Systems
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- Kishore Sengupta Associate Professor of Information Systems
- William B. Short Lecturer
- Suresh Sridhar Visiting Assistant Professof of Information Systems
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Research Areas

Software Engineering, Project Management, Software Reuse, Dynamic Decision Making, and System Dynamics

Research Description

Over the last ten years, my research has focused on applying the system dynamics modeling technique to study the dynamics of software project management. This has led to the development of a hierarchy of interrelated models to study single-project dynamics, multi-project dynamics (e.g., multiple projects sharing common resources), and organization-wide dynamics (e.g., impacts of organization-wide policies for software reuse). Through modeling and simulation, these models serve as experimentation laboratories to study software project management phenomena and gain a better understanding of the dynamically complex interactions and trade-offs that characterize software project management.

In addition, the models serve as computer-based management support tools to evaluate/design organizational policies (e.g., setting software reuse goals, allocating quality assurance resources, etc.). The models are currently being used in more than forty organizations worldwide (organizations such as NASA, Hewlett-Packard, and Siemens).

I am using my suite of simulation tools as experimenation microworlds to study dynamic decision making in the software management domain (e.g., study the impact of individualistic versus cooperative reward schemes on project resource allocations). I am also working on the development of intelligent tutoring interfaces to the system dynamics models of software project management in order to use them as learning laboratories for NPS students and DoD software project managers. (This is analogous to the use of flight

simulators in training pilots.)

Relevance to DoD/DoN

The impressive innovations in the technology of software production that have been made over the last three decades have not been matched by a corresponding maturity in the capability to manage the production of software. As a result, there continues to be too many project failures, marked by cost overruns, late deliveries, poor reliability, and user dissatisfaction.

Recently, it has become more and more evident within DoD that in software, product innovation is no longer the primary bottleneck to progress, the bottleneck is project management innovation.

Recent Publications

Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck. The Effect of Reward Structures on Allocating Shared Staff Resources Among Interdependent Software Projects: An Experimental Investigation. IEEE Transactions on Engineering Management Vol. 41, No. 2, (May 1994):115-125.

Abdel-Hamid, T., K Sengupta, and D. Ronan. Software Project Control: An Experimental Investigation of Judgment under Fallible Information. IEEE Transactions on Software Engineering Vol. 19 (June 1993):603-612.

Sengupta, K. and Abdel-Hamid, T.K. An Investigation of Alternative Feedback Strategies in Dynamic Decision Making. Management Science (April 1993): 411- 428.

Abdel-Hamid, T.K. Adapting, Correcting, and Perfecting Software Estimates: A maintenance Metaphor. Computer (March 1993): 20-29.

Abdel-Hamid, T.K. and S.E. Madnick. Software Project Dynamics: An Integrated Approach. New York: Prentice-Hall, (1991).

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Research Areas

Decision Support Systems, Computer-Aided Modeling, Logic Modeling, Artificial Intelligence

Research Description

My research is focused on the decision sciences, and involves computer-aided mathematical modeling, logic modeling, and artificial intelligence. My current work develops methods for using the Internet to allow global sharing of computer-based decision technologies. My general research interests include the modeling process, developing formal languages and systems for modeling and reasoning, and exploring the interface qualitative and quantitative methods for modeling and reasoning.

Research Projects:

DecisionNet

The DecisionNet project aims to develop software infrastructure that offers access to a globally distributed network of modeling and decision support systems. Using the World Wide Web, DecisionNet allows providers to publicize and make available their technologies to consumers who can search, connect to, and use them. The project investigates several issues arising from the creation of this electronic marketplace of decision technologies.

Integrated Modeling Environments

Computer-aided modeling environments are designed to facilitate the construction, exercise, and management of mathematical models for decision making. Representative topics investigated in this project are: Philosophy and principles of modeling; Embedded languages as an architecture for modeling systems; Extensions to formal modeling languages; Computer-aided model construction.

Post-evaluation Analysis of Mathematical Models

What-if analysis is a standard feature in decision support systems. We investigate how computer-aided modeling systems may be used to search -intelligently and automatically -complex decision spaces in order to find high quality policy options.

Fleet Mix Planning

Fleet mix planning involves determining the optimal mix of assets that an organization must hold in order to optimize its defined objective while satisfying environ- mental and organizational constraints. We survey methods for fleet planning, and develop models and decision policies for fleet mix planning in the U.S. Coast Guard.

Relevance to DoD/DoN

Professor Bhargava s research has been funded by the U.S. Coast Guard, the U.S. Army Artificial Intelligence Center, and by funds from DARPA/ASTO.

Recent Publications

Bhargava, H.K., R. Krishnan, and A.B. Whinston. On Integrating Modeling and Collaborative Technologies. *Journal of Organizational Computing* Vol 4, No 3 (1994).

Bhargava, H.K. and S.O. Kimbrough. Model Management: An Embedded Languages Approach. *Decision Support Systems* Vol 10, No 3 (1993): 277-300.

Bhargava, H.K. Dimensional Analysis in Mathematical Modeling Systems: A Simple Numerical Method. *ORSA Journal on Computing* Vol 5, No 1 (1993): 33-39.

Bhargava, H.K. and R. Krishnan, Computer-aided Model Construction. *Decision Support Systems* Vol 9, No 1 (1993): 91-111.

Bhargava, H.K., R. Krishman, and S. Mukherjee. On the Integration of Algebraic and

Data Modeling Languages. *Annals of Operations Research* Vol 38 (1992): 69- 95.

Bhargava, H.K., S.O. Kimbrough, and R.Krishnan. Unique Names Violations, a Problem for Model Integration or You Say Tomato, I Say Tomahto. *ORSA Journal on Computing* Vol 3, No 2 (Spring 1991): 107-120.

Recommended Links

Hemant Bhargava's WWW Home Page
Hemant Bhargava's Decision Support Systems Page
Hemant Bhargava's Computer-Aided Modeling Page

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Research Areas

Computer Networks, High Availability Networking, and Radio-WAN Development

Research Description

My research specializes in adaptation of commercial networking technology for military purposes with focus on maintained high availability. Military and civilian emergency services requirements for Computer networks generally include:

- High availability and survivability
- Extension of internetworks into radio-WAN environment to reach mobile platforms
- Security requirements that exceed commercial Internet needs. My work focuses on these areas

Radio-based WAN requirements impact protocol suites in different ways than conventional wired networks. Testbed and protocol design requirements in this area includes:

-
- Low interactivity networks
- Reliable multicast
- Mobile hosts
- Multiple data types with multiple QoS needs
- Incorporation of one-way data feeds into networks
- Fast setup requirements

Developing evolutionary action plans that allow incremental growth and real action with

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recognition that requirements are not well known or defined is required to achieve the desired goals in High Availibility Networking.

These two requirements lead to several contributory topics that include:

- Low Earth Orbit satellites
- Wireless network technology development
- Network management
- Secure messaging
- Network protocol architecture
- Export education to USCG, NAVSEA, NRaD on networking
- Consulting and research work to NAVSEA (submarinesyscom), SPAWAR (Next Generation Computer Resources), NAVAIR (NavAirWide Area Network), and ARPA (network-to-fleet)
- Program planning, prototype work for Joint Oceanographic Institution and Taking the Internet to Sea for the Oceanographic Fleet

My research project, Taking the Internet to Sea, can be found at http://vislab-www.nps.navy.mil/~seanet.

Relevance to DoD/DoN

Continued operations and high levels of survivability are often required for todays computer networks. With regards to WAN s, taking the Internet to the fleet represents major improvement in C3I systems.

Recent Publications

Buddenberg, Rex. Computer Networking and C3I Systems for Emergency Services, (1993). Available on:

- ftp.nps.navy.mil in pub/sm/budden/text_word or ~/text_wp and on http://vislab-www.nps.navy.mil/~budden

Buddenberg, Rex. Ship-Shore Packet Switching. Masters Thesis, Navy Postgraduate School (1986).

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Research Areas

Decision and Negotiation Support Systems, Implementation of Information Systems in Large Organizations

Research Description

My primary research interests include implementation of information systems in large organizations, group decision and negotiation support systems, crisis management support systems, and design of distributed knowledge-bases for organization decision making. My research has been funded by a number of DoD agencies (such as the Office of the Director of Defense Information, SPACECOM, NAVAIR, TRADOC) and international science foundations (such as the Canada Council for Social Sciences, the Swiss National Science Foundation, and the Hong Kong Science Foundation).

Research Projects:

Collaborative Multimedia Systems for Crisis Management

Given the constant change in economic and social conditions, the formulation of a comprehensive strategic plan to deal with crises is an ever increasingly urgent, complex task. The proposed project applies state-of-the- art collaborative multimedia technology to the design of computer-based systems that support crisis management.

Negotiation Support Systems for Inter-Cultural Negotiation

This research focuses on the design, implementation and evaluation of negotiation support systems to support intercultural, multi-language negotiations. This approach seeks to expand current research in the field of computerized group decision and

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negotiation to an international context in which cultural and linguistic issues constitute an integral part of the negotiation process.

Supporting Argumentation in Software Development Project

The purpose of this research is to develop an argumentation language to support software development projects managed in a geographically dispersed setting and in an asynchronous mode.

Design of a Distributed Decision Support System for Optimizing the Utilization of Military Satellite Resources

The management of military telecommunications services in a crisis situation requires adhoc, quick planning and negotiation among different organizations involved in the deployment, use, and financing of satellite resources. This research proposes an enterprise-wide computing architecture to support a variety of geographically dispersed functional tasks yet centrally managed by SPACECOM.

Relevance to DoD/DoN

My research directly impacts on the efficiency and effectiveness of the SPACECOM organization.

Recent Publications

Binbasioglu, T. Bui and Ma. An Action-Resource Language for Argumentation: The Case of Softwood Lumber Negotiation. 28th Hawaii International Conference in System Sciences (January 1995).

Bui, Tung and Mak. An Empirical of Neural Networks in Strategic Decision Making. Proceedings of WITS, Vancouve (December 1994).

Bui, Tung and Petrazzini. Vietnam: Rapid Growth and Cautious Reform. Telecommunications Journal (October 1994).

Bui, Tung and Mak. Modeling Expert s Knowledge: The New Product Entry Problem. IEEE Conference of Software Engineering, Austin, Texas (April 1994).

Bui, Tung. Evaluating Negotiation Support Systems: A Conceptualization , 27th Hawaii International Conference in System Sciences, Vol 3 (January 1994).

Bui, T. and Strand. A Neural Net Model to Represent Negotiators Heuristics. 25th
Hawaii International Conference in System Sciences Vol 3 (January 1993).

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Research Areas

Model Management and Evolutionary Information Systems

Research Description

Decision making and application system development are two vital activites for organizations in the Information Age. Both processes depend heavily upon models as vehicles for representing the context in which decisions are made and systems function. Conceptual modeling is central to understanding organizational requirements for computing technology.

My research has been primarily dedicated to the development of computing environments which facilitate the representation, integration, and understanding of mathematical models for decision making. Much of this work has involved static models such as mathematical programming, statistics, and database design.

My current interest is in information systems as evolutonary artifacts which are rich in dynamic behavior. Understanding the interplay between organizations and computing technology requires recognition of the essentially nonlinear, feedback-based nature of the phenomena being modeled. I am particularly interested in approaching enterprise modeling from this perspective and am looking to recent advances in the theory of complex adaptive systems as a guide for providing more robust models from which decision support and information systems can prosper.

Relevance to DoD/DoN

The cost of application system development and maintenance in DoD is staggering. The

search for lower cost alternatives to the current modus operandi has reached Holy Grail status. Radical solutions may be required. Approaching system development as a generative, dynamic phenomenon rather than a static structured process may offer insight into more effective ways to control this activity.

Recent Publications

Dolk, D.R. and M.H. Ackroyd. The Role of Object Technology in Enterprise Modeling. Naval Postgraduate School Technical Report, Systems Management Department, Monterey, CA 93943 (1995).

Dolk, D.R. and K.J. Euske. Model integration: Overcoming the stovepipe organization. Advances in Management Accounting, Vol. 3., M.J. Epstein and K.M. Poston (Eds), JAI Press, Inc., (1994).

Dolk, D.R. and J.E. Kottemann. Model Integration and a Theory of Models. Decision Support Systems, Vol. 9 (1993): 51-63.

Dolk, D.R., D.G. Castillo, D.J. Kridel. GOST: An active modeling system for costing and planning NASA space programs. Journal of Management Information Systems,Vol. 6 No. 1 (January 1992).

Dolk, D.R. and D.J. Kridel,. An active modeling system for econometric analysis. Decision Support Systems, Vol. 7 (1991).

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Research Areas

Application Development

Research Description

The conventional process for developing application software has a long history of problems. The process can be characterized by the use of a disciplined structured methodology and programming in a 3GL procedural language. Applications under development are often delivered substantially over budget and schedule or not at all. Worse, the applications, once delivered, often fail to meet the needs of users. Their inflexibility makes them expensive to maintain and difficult to adapt to changing needs.

A number of new approaches seem likely to make significant improvements in application development. These include the use of Commercial-Off-The-Shelf (COTS) products, application templates, reusable objects and components, middleware, and 4th-generation languages. A particular challenge is to provide integrated, interoperable systems in a client/server environment.

We are currently concentrating our research efforts on the development of information systems for the Naval Postgraduate School. The School provides a microcosm of the broader issues found throughout the Department of Defense: multiple networks, stovepipe (non-integrated) application programs, and lack of a powerful infrastructure. Our initial focus is on enhancing the campus network, providing standard directory and e-mail services, and performing a work flow analysis of administrative systems. Once an effective infrastructure is put in place, we will develop applications using COTS products, Middleware, and a client/server-based 4GL. The intention is to develop guidelines for application development, based on our experience at NPS.

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Relevance to DoD/DoN

DoD spends about $30 billion a year on software development and maintenance. Cost is not the only concern: the emerging information warfare environment makes effective software development of great strategic importance. Improving the process of developing and maintaining application software is therefore of enormous importance to DOD.

Recent Publications

Emery, J. New Approaches to Application Development, Proceedings of IT2000 Symposium, Singapore. (1995): 10.

Emery, J. C. Report of the Committee on Computing. Naval Postgraduate School, Monterey, CA, (July 1994): 32.

Emery, James C. and Dani Zweig. The Use of Ada for the Implementation of Automated Information Systems within the Department of Defense. Naval Postgraduate School (December 1993): 33.

Emery, James C. The Global Organization as the Norm. Journal of Global Information Management Vol. 1 No. 3 (Summer 1993):3-4, 31, 44.

Emery, James C., Tung X. Bui and Cheryl D. Blake. Prototyping with Application Generators: Lessons Learned from the Naval Aviation Logistics Command Management Information System Case. Naval Postgraduate School (October 1992): 56.

Emery, James C. Downsizing the Enterprise. SIM Network Vol. 7, No.1 (Jan-Feb 1992).

Emery, James C. The Strategic Implications of a Productive Software Development Process. Proceedings of the Workshop on Information Technologies and Systems, M.I.T. (December 1991): 15.

Emery, James C. ADA and Management Information Systems: Policy Issues Concerning Programming Language Options for the Department of Defense. Naval Postgraduate School, Monterey, CA, (June 1991): 102.

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Research Areas

Executive IT Management and Education; Software Engineering, Project Management, & Enterprise Integration

Research Description

My research examines various approaches to executive education with respect to information technology management issues within DoN. In addition, it involves the study of critical success factors for IT management within DoD/DoN activities; My research also involves the study of various approaches to integrating and interconnecting applications to increase the efficiency and effectiveness of enterprise- wide information management support. The intent is to develop real applications for real use at NPS (because NPS is viewed as a microcosm of DoN/DoD s information environment), using a wide spectrum of technical approaches.

Relevance to DoD/DoN

TOPSAIL, the result of this work, is a program for systematic and complete coverage of Information Technology Management topics for Navy Flag Officers and SES civilian employees. The topics covered include information management issues relevant to DoN high level managers. This high level education program is envisioned as a tool for improving decisions with respect to the selection, acquisition, deployment, use and maintenance of information system resources throughout the DoN.

Recent Publications

Frew, Barry. Training and Educating IS Professionals to Manage Information Technology in Changing Organizations. Proceedings, SIGCPR 94, Reinventing IS: Managing Information Technology in Changing Organizations (March 1994).

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Research Areas

System Productivity Metrics

Research Description

I am an émigré from organization theory where I enjoyed a minor reputation for identifying the role-making process in organizations. My IT interests are two-fold. First, I am concerned about the research methods used to assess the productivity of information systems. Secondly, I am drawn to look at the impact of information technology upon work relationships in organizations and upon society and culture at large.

I measured the effectiveness of the SACONS and APADE contract-generation systems by collecting field data on inputs and outputs in a pre- experimental design. I wrote a case study of DOD s consolidation and standardization of information systems through its Corporate Information Management program. I assisted the Office of the Director of Defense Information in developing guidance for DOD managers to undertake business process re-engineering. To this end, I directed the development of the REAP database. I also proposed an automation of the budget forecasting and planning module of the Navy Bureau of Medicine s executive information system.

I recently helped Fleet Numerical Meterology and Oceanographic Center experiment with focus groups as a means to assess system effectiveness from their customers perspective.

Relevance to DoD/DoN

My work has helped DoD organizations considering off-the-shelf software for the automation of small purchases and contracts. I have directly assisted the Office of the Director of Defense Information in developing a database of organizations that are candidates for benchmarking.

Recent Publications

Haga, W. J. and M. Zviran. Information Systems Effectiveness: Research Designs for Causal Inference. Journal of Information Systems Vol. 4 (July 1994): 141-166.

Haga, W. J. and J. D. Harrigan. Planning for natural disasters: U.S. DoD Experience. Proceeding of Computer Security International 93, London (October 1993): 19-22.

Haga, W. J. and M. Zviran. Key Issues In IS Management: The U.S. DoD Perspective. Defense Analysis Vol. 9, No.2 (August 1993):197-210.

Zviran, M. and W. J. Haga. Question And Answer Passwords: An Empirical Evaluation . The Computer Journal Vol. 35, No. 3 (1993).

Euske, K.J. and W. J. Haga. Process For Improving Processes: Elements And Issues. Consortium for Advanced Manufacturing International-Cost Management Systems Programs, San Diego (March 1993).

Haga, W. J. and M. Zviran. Cognitive Passwords: Key to Easy Access Control. Computers and Security Vol. 9 (December 1990): 723-736.

Haga, W. J. and M. Zviran. Comparison of Password Techniques. Proceedings of Computer Security International 90, London, (October 1990): 285-295.

Henderson, D. R. and W. J. Haga. How to Account for Inflation When Taking Present Values. Naval Postgraduate School Technical Report, Systems Management Department, NPS-54-90-020 (September 1990)

Haga, W. J. and M. Zviran. Password Security: An Exploratory Study . Naval Postgraduate School Technical Report, Systems Management Department, NPS-54-90-011 (May 1990).

Zviran, M. and W. J. Haga. A Comparison of Password Techniques for Multilevel Authentication Mechanisms. Naval Postgraduate School Technical Report, Systems Management Department, NPS-54-90-014 (May 1990).

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Research Areas

Interoperability and Integration of Heterogeneous Databases

Research Description

Interoperability and integration of heterogeneous databases is one of the main challenges facing today s medium and large-size organizations. We are currently pursuing two different approaches to address this problem.

The first approach addresses the theoretical and practical issues associated with building systems that facilitate interoperability and integration of existing systems while preserving their autonomy and considerable investment. Foremost of these issues is the identification and resolution of semantic heterogeneity that exists among these systems. To address that issue, we have developed a comprehensive framework for identifying, classifying, and resolving semantic heterogeneity for different data models. The second approach investigates methodologies to gradually reverse-engineer old systems into new integrated and cleanly structured systems that follow modern principles of good design, conform with the data and process models of the enterprise, and comply with accepted standards, therefore increasing their ability to share information with other systems in addition to being easily maintained and enhanced.

Relevance to DoD/DoN

One of the main challenges facing DoD/DoN is the proliferation of a large variety of incompatible database systems and their associated applications. As the number of databases increases, so does the need to interoperate many of those applications and integrate them into an overall strategic information system.

Our work addresses these issues by investigating the theoretical and practical issues involved in building systems to facilitate the interoperation and integration of these systems and by addressing the issue of reverse engineering legacy system into modern systems that facilitate data sharing and integration.

Recent Publications

Kamel, M. N. Identifying, Classifying, and Resolving Semantic Conflicts in Distributed Heterogeneous Databases: A Case Study. Journal of Database Management Vol. 6, No. 1, (Winter 1995): 20-32.

Ceruti, M. G. and M. N. Kamel. Semantic Heterogeneity in Database and Data Dictionary Integration for Command and Control Systems. Proceedings of the 11th Annual Department of Defense Database Colloquium, Database 94, San Diego, CA (August 1994): 65-88.

Kamel, N. N., T. Song, and M. N. Kamel. An Approach for Building and Integrated Environment for Molecular Biology Database, Journal of Distributed and Parallel Databases Vol. 1, No. 3 (July 1993): 303-327.

M. N. Kamel and N. N. Kamel. The Federated Database Management System: Requirements, Issues and Solutions. Journal of Computer Communications Vol. 15, No. 4 (May 1992): 270-278.

D. K. Hsiao and M. N. Kamel. Heterogeneous Databases: Proliferations, Issues and Solutions. IEEE Transactions on Knowledge and Data Engineering Vol. 1, No. 1, (March 1989): 45-62.

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Research Areas

Knowledge-Based Support for Systems Development

Research Description

Large scale systems development and maintenance efforts are often hindered because much of the richness of the design process, namely the design rationale, involving the deliberations on alternative design decisions is lost in the course of designing and changing such systems. We have developed a model that is geared towards capturing the rationales behind design decisions and using this knowledge to reason about changes in design decisions. The use of this model for representation and reasoning with rationale behind requirements and design decisions will greatly aid the development and maintenance of large scale systems. A major objective of our research is to elevate the process of systems maintenance to the level of specifications and the rationale behind their creation. Development of models and mechanisms to capture and reuse rationale to support various systems development activities is the primary focus of this work.

Development of complex, mission critical systems involves modification, refinement and evolution of initial requirements that lead to design solutions. In order to provide intelligent and useful support to the process of design and maintenance, a formal representation of the linkages between the design solutions, the requirements and their sources is essential. A comprehensive traceability scheme should not only identity traceability linkages to be maintained, but also provide the mechanisms to support use in systems development and maintenance activities. Based on an extensive empirical study of systems development personnel, we have developed several models for requirements traceability.

Relevance to DoD/DoN

Reducing systems development and maintenance costs and improving the quality and reliability of systems are of major concern for the DoD/DoN. Our work focuses on developing models and mechanisms that will help capture knowledge about the systems development process and use this knowledge to support a variety of stakeholders involved in development and maintenance of the system as well as in future projects. Such a reuse of process knowledge is expected to increase systems development and productivity significantly.

Recent Publications

Ramesh, B. and K Sengupta. REMAP/MM: Multimedia in Decision Support with Design Rationale. Decision Support Systems (November, 1994).

Ramesh, B. and Luqi. An Intelligent Assistant for Requirements Validation for Embedded Systems. Journal of Systems Integration Vol. 5, No. 2. (1995).

Ramesh, B. et al Implementing Requirements Traceability. Proceedings of the IEEE International Symposium on Requirements Engineering York, UK (March 1995).

Ramesh, B. and K. Sengupta. Managing Cognitive and Mixed-Motive Conflicts in Concurrent Engineering. Concurrent Engineering Research and Applications Vol. 2, (1994): 223-236.

Ramesh, B. and V. Dhar. Representation and Maintenance of Process Knowledge

for Large Scale Systems Development. IEEE Expert, Special Series on Knowledge Based Software Engineering (April 1994).

Ramesh, B. and M. Edwards . Issues in the Development of a Model for Requirements Traceability. In Proceedings of the IEEE International Symposium on Requirements Engineering, San Diego, CA (January 1993).

Ramesh, B. and V. Dhar. Supporting Systems Development by Capturing Deliberations during Requirements Engineering. IEEE Transactions on Software Engineering (June 1992).

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Research Areas

Software Reliability and Software Metrics

Research Description

Software Reliability

Research was conducted on the feasibility of optimally selecting failure data in order to identify the optimal set of model parameters that would result in maximum predictive accuracy, using the Schneidewind Software Reliability Model as a vehicle for the research. The research showed that significantly improved reliability predictions can be obtained by using a subset of the failure data, based on applying the appropriate criteria, and using the Space Shuttle On-Board software as an example.

Software Metrics

A comprehensive metrics validation methodology was developed that has six validation criteria which support the quality functions: assessment, control and prediction. New criteria were defined and illustrated, including: consistency, discriminative power, tracking and repeatability. It was shown that non-parametric statistical methods play an important role in evaluating metrics against the validity criteria. It was also shown how metrics that have been validated on a current project can be applied on a future project. A non-parametric statistical method was developed for finding the critical (i.e., threshold) values of metrics. Critical values are identified by applying the discriminative power criterion and are applied in quality control to identify potentially low quality software. It was shown how to do a cost sensitivity analysis on the critical values in order to tradeoff the cost of inspection against the cost of software failures. Lastly, it was shown how metrics that have been validated against the criteria discriminative power and tracking can be used in maintenance to: 1) establish quality control objectives; and 2) prioritize

software components (e.g., modules) and allocate resources to maintain them.

Relevance to DoD/DoN

As a result of my software reliability research, an enhanced version of the Schneidewind Software Reliability Model was implemented in Version 5 of the Naval Surface Warfare Center (NSWC) SMERFS software reliability tool, which has been acquired by numerous DoD agencies and contractors. In addition, the model is used at NSWC for research in reliability prediction and analysis of the TRIDENT I and II Fire Control Software.

My software metrics research has also been applied by NSWC to validate metrics for quality assurance of the TRIDENT I and II Fire Control Software.

Recent Publications

Schneidewind, Norman F. Controlling and Predicting the Quality of Space Shuttle Software Using Metrics. Software Quality Journal (1995): 49-68.

Schneidewind, Norman F. Validating Metrics for Controlling and Predicting the Quality of Space Shuttle Flight Software. IEEE Computer Vol. 27, No. 8, (August, 1994): 50-57.

Schneidewind, Norman F. Software Reliability Model with Optimal Selection of Failure Data. IEEE Transactions on Software Engineering Vol. 19, No. 11 (November 1993): 1095-1104.

Schneidewind, N. F. and T.W. Keller. Application of Reliability Models to the Space Shuttle. IEEE Software Vol. 9, No. 4 (July 1992): 28-33.

Schneidewind, Norman F. Methodology for Validating Software Metrics. IEEE Transactions on Software Engineering, Vol. 18, No. 5 (May 1992): 410-422.

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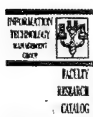
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Kishore Sengupta
Associate Professor
PhD, Case Western Reserve UNIV., 1990
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Research Areas

Decision Making and Decision Support in Dynamic Environments, Computer- Supported Collaborative Work, Multimedia and Intelligent Tutoring Systems

Research Description

My principal research interests are in the cognitive aspects of behavioral decision theory and their application to the design of information systems. Research in this area is driven to two broad goals: to engage in a systematic study of how decisions are made in individual and collaborative situations, and to apply the findings in formulating design principles for decision support systems.

Within the context of these objectives, I have pursued three themes: feedback/feed forward, dynamic decision environments, and collaborative work. My work on feedback and feed forward examines the comparative efficacies of different types of feedback and feed forward mechanisms (particularly cognitive feedback) in improving decision quality. Much of this work has been conducted in dynamic decision environments in the context of individual and collaborative work situations. The research questions have been examined in experimental settings with computer- supported microworlds that incorporate the complexities and sophistication of real- world settings.

My work in multimedia concerns the use of the technology in the development of interactive instructional systems. I am currently examining the feasibility of building systems in domains that require perceptual learning. One such application is in the area of night vision goggles, which are used by aviators for flying at night. Night vision goggles create a representation of the external environment that is dramatically different from that perceived in daylight conditions. Flying in such environments, therefore, requires extensive training. My research in this area entails building a prototype instructional system that incorporates multimedia, night vision imagery, and synthetic

visual environments.

Relevance to DoD/DoN

The relevance of my research on dynamic environments to the DoD/DoN lies in the fact that military decision situations tend to be complex, uncertain, and dynamic. Thus, the ability to provide effective decision support is important to performance in such environments.

Recent Publications

Sengupta, K. Cognitive Feedback in Environments Characterized by Irrelevant Information. OMEGA: International Journal of Management Science Vol. 23 (1995):125-143.

Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck. The Impact of Reward Structures on Staff Allocations in a Multi-project Software Development Environment. IEEE Transactions on Engineering Management Vol. 41 (1994): 115- 125.

Ramesh, B. and K Sengupta. REMAP/MM: Multimedia in Decision Support with Design Rationale. Decision Support Systems (November, 1994).

Ramesh, B. and K. Sengupta. Managing Cognitive and Mixed-Motive Conflicts in Concurrent Engineering. Concurrent Engineering Research and Applications Vol. 2 (1994): 223-236.

Abdel-Hamid, T.K. and K. Sengupta. Software Project Control: An Experimental Investigation of Judgment with Fallible Information. IEEE Transactions on Software Engineering Vol. 19 (June 1993): 603-612.

Sengupta, K. and D. Te eni. Cognitive Feedback GDSS: Improving Control and Convergence. MIS Quarterly Vol. 17 (1993): 87-114.

Sengupta, K. and Abdel-Hamid, T. Alternative Conceptions of Feedback in Dynamic Environments: An Experimental Investigation. Management Science Vol. 39 (1993): 411-428.

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Research Areas

Telecommunication Systems and Decision Support Systems

Research Description

The dramatic changes in computing technology coupled with increased demands for computing power has led several organizations to shift towards distributed computing systems. Thus, tasks are processed in parallel by several processors under this scenario. One of the major research issues in this area is to optimally balance the workload among several processors. Load balancing can be either static or dynamic. We have proposed improved algorithms for the static load balancing problem where the workload can be distributed in any proportion among the processors. This also serves as a lower bound for cases where the tasks cannot be split among processors. We are currently developing algorithms for the dynamic load balancing problem.

The field of mobile communication networks is another area which is becoming increasingly important. For example, cellular networks, which fall under this category, have been growing at an explosive rate. The objective of this research is to develop optimal policies for configuring cellular networks. In particular, this research will address the following issues: management of existing facilities, investment in expanding existing facilities and configuring new facilities, and the impact of these decisions on the quality of service. It attempts to answer questions such as: What policies are required to effectively manage the network? When is a policy most effective? What are the implications of using one policy over another? It attempts to incorporate the various technical, operating and regulatory constraints in developing the optimal policies. Finally, it examines the implications of using these policies for managerial decision-making.

Relevance to DoD/DoN

The results from the above research can be useful for various agencies of the DoD/DoN in improving the effectiveness of command and control. Modern warfare requires quick deployment of personnel and sophisticated weapon systems. The use of mobile communication systems such as cellular networks enhance the provision of tactical communications to deployed forces who are constantly on the move. By using optimal policies in configuring such networks, it is possible to ensure their cost- effectiveness and maintain the specified quality of service.

Recent Publications

Gavish B. and S. Sridhar. Economic Aspects of Configuring Cellular Networks. Wireless Networks Vol 1, No 1 (Jan.1995).

Gavish, B., J. Gerdes, and S. Sridhar. CM3, Looking into the Third and Fourth Dimensions of GDSS. Integration, Information and Collaboration Models. Kluwer Academic Pub. (1994): 269-299.

Gavish, B., and S. Sridhar. O(n) Algorithms for Load Balancing in Distributed Computing Systems." Computers and Operations Research Vol. 21, No 3 (1991): 239-248.

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Faculty Research Areas

The Information Technology Management Group's current research efforts fall into the following five broad categories:

- Model Management
- Database Management Systems
- Decision Support and Expert Systems
- Software Engineering and Applications Development
- Networks and Communications

A brief overview of each catgegory is presented below.

Model Management

The role of modeling is central to the understanding of organizations and to the development of information systems that meet the needs of organizations. Models are used in decision making as well as information systems analysis and design. Creating computer-based environments wherein complex models can be easily represented, manipulated, integrated, and understood is an important objective of software engineering and decision support.

Professor Daniel Dolk's academic contributions have been in the design and construction of software environments to support mathematical programming and statistical analysis. This requires the synthesis of many different fields, including database management, artificial intelligence, operations research, cognitive psychology, and software engineering.

His current interests are in object-oriented enterprise modeling, complex adaptive systems, and symbiotic, or active, modeling systems that incorporate neural network, genetic algorithms, and expert system technology to actively assist the user in data exploration as a precursor for building good statistical models.

Computer-aided modeling environments, or model management systems, are designed to facilitate the construction, exercise, and management of mathematical models for decision making. Professor Bhargava's research has contributed to the development of

modeling environments in a variety of ways; his niche in this field is in the use of formal logic in developing representation and reasoning models for important components of these systems.

Some topics investigated in Professor Bhargava's research involve modeling principles and philosophy, architectures for modeling environments, and system functions that involve qualitative and symbolic reasoning. A chief contribution of his research is the embedded languages technique that provides an architecture for building modeling environments, allows these systems to represent and reason with a variety of qualitative information, and integrates multiple modeling languages.

Publications:

Dolk, D.R. and D.J. Kridel. Modeling Telecommunications Demand Interfaces Vol. 23, No. 2 (1993).

Dolk, D.R. and J.E. Kottemann. Model Integration And A Theory Decision Support Systems, Vol. 9 (1993): 51-63.

Dolk, D.R., D.G. Castillo, D.J. Kridel. GOST: An active mode costing and planning NASA space programs. Journal of Managemen Information Systems, Vol. 6, No. 1 (January 1992).

Bhargava, H.K., R. Krishnan, and P. Piela. Formalizing the Se ASCEND. Proceedings of the Twenty-Seventh International Confe System Sciences, Maui, HI (January 1994).

Bhragava, H.K. Dimensional Analysis in Mathematical Modeling S Simple Numerical Method. ORSA Journal on Computing Vol. 5, No. (1993): 33-39.

Bhargava, H.K. and S.O. Kimbrough. Model Management: An Embed Languages Approach. Decision Support Systems Vol. 10:3, (1993)

Bhargava, H.K. and R. Krishnan. Computer-aided Model Construct Decision Support Systems Vol. 9: No. 1, (1993): 91-111.

Database Management Systems

Databases and database technology are having a major impact on the growing use of computers. They play a major role in almost every information system technology and all areas where computers are used.

Professor Kamel s main research interest area is the design, implementation, and application of database systems. Specifically, he is interested in data modeling and query languages, data quality, data integrity, object-oriented database systems, integration of databases with decision support and expert systems, and interoperability and integration issues of heterogeneous databases.

The last issue, interoperability and integration of heterogeneous databases, is of particular interest and is the focus of his current research activity. He is pursuing two different approaches to address this problem. The first approach addresses the theoretical and practical issues associated with building systems that facilitate interoperability and integration of existing systems while preserving their autonomy and considerable investment. The second approach investigates methodologies to gradually reverse-engineer old systems into new integrated and cleanly structured systems that follow modern principles of good design, conform with the data and process models of the enterprise, and comply with accepted standards, therefore increasing their ability to share information with other systems in addition to being easily maintained and enhanced.

Publications:

Kamel, M. N. Identifying, Classifying, and Resolving Semantic Distributed Heterogeneous Databases: A Case Study." Journal of Management, Vol. 6, No. 1, (Winter 1995): 20-32.

Ceruti, M. G. and M. N. Kamel. Semantic Heterogeneity in Datab Dictionary Integration for Command and Control Systems. Proceed 11th Annual Department of Defense Database Colloquium, Database Diego, CA (August 1994): 65-88.

Kamel, N. N. , T. Song, and M. N. Kamel. An Approach for Build Integrated Environment for Molecular Biology Database." Journal and Parallel Databases Vol. 1, No. 3, (July 1993): 303-327.

Decision Support and Expert Systems

Decision Support Systems

Computer-based systems to support the various aspects of decision making, including generation of alternatives, their evaluation and choice.

Sridhar s work focuses on group decision support systems to address the challenges of meetings distributed in time and space. A prototype system called the Computer Mediated Meeting Management (CM3) has been developed to facilitate group consensus formation and to enhance the group decision making processes.

The CM3 system supports participant anonymity, triggering of new thought processes, group memory providing fully documented meetings, and the ability to support long duration meetings. In addition, it supports dynamic formation of subgroups within meetings. It consists of several modules for question generation, brainstorming, consolidation, voting, ranking and resource allocation.

Publications:

Gavish, B., J. Gerdes, and S. Sridhar.   CM3   A Distributed Gr Support System." IIE TRANSACTIONS.

Gavish, B., Gerdes, J., and S. Sridhar.   CM3, Looking into the Fourth Dimensions of GDSS." in INTEGRATION, INFORMATION AND COLLABORATION MODELS, Kluwer Academic Pub., 1994, 269-299.

Decision Making in Dynamic Environments

Research in dynamic decision environments is motivated by the recognition that many decision situations (such as combat decision making) are dynamic in nature. Research in this area is typically carried out with three objectives:

- Ascertain how individuals and groups cope with complex dynamic environments,
- Design appropriate organizational structures to facilitate adaptation by teams in such environments, and
- Establish design principles for building decision support systems for dynamic environments.

Professor Kishore Sengupta s contribution in this area has been in expanding our understanding of how individuals and groups make decisions in such environments, and in establishing the comparative efficacies of different feedback and feedforward mechanisms in dynamic environments. He is currently examining the question of adaptive coordination in the context of an ONR-funded project on flexible organizations.

Publications:

Sengupta, K. and T. Abdel-Hamid.   Alternative Conceptions of Fe
Dynamic Environments: An experimental Investigation.   Manageme
Vol. 39,(1993): 411-428.

Abdel-Hamid, T., K. Sengupta, and D. Ronan. Software Project Co
Experimental Investigation of Judgment under Fallible Informatio
Transactions on Software Engineering, Vol. 19, (1993): 603-612.

Sengupta, K.   Cognitive Feedback in Environments Characterized
Information.   OMEGA: International Journal of Management Scienc
(1995): 125-143.

Sengupta, K., C. Jones, and B. Wright.   Adding Intelligence to
Distributed Decision Making.   Proceedings of the JDL Symposium
Command and Control, Monterey, CA.

Instructional Multimedia Systems

Instructional multimedia systems offer the potential of engendering fundamental changes in the way we learn. The design of effective instructional systems thus carries important implications for training and education in the workplace. The objective of this project is to develop and evaluate interactive multimedia systems for instruction in complex tasks.

Professor Kishore Sengupta s contribution to this project has been primarily in the design and construction of multimedia systems for instruction. Much of this work has been conducted in the context of training for night vision goggles. Night vision goggles are being used widely by aviators for flying in night time and low light conditions. Such goggles are used for a wide variety of tasks, ranging from combat missions to medical evacuation procedures. The representation of the external world offered by night vision goggles is dramatically different from normal (daylight) perception. Thus, without adequate training in the use of these goggles, even otherwise experienced aviators are prone to committing errors that would not normally occur in daylight conditions. In the absence of suitable training mechanisms, the increasing use of night vision goggles has been accompanied by a dramatic rise in accident rates.

As part of a multi-year project funded by the Naval Air Systems Command, Professor Sengupta is building a hypermedia instructional system that will enable aviators to learn critical perceptual skills required for the effective use of night vision goggles. The system will provide self-paced instruction, along with practice and rehearsal sessions. The system will also evaluate students on their progress.

SOFTWARE ENGINEERING AND APPLICATIONS DEVELOPMENT

Software Engineering and Project Management

Professor Abdel-Hamid has focused on applying the system dynamics modeling technique to study the dynamics of software project management. This has led to the development of a hierarchy of interrelated models to study single-project dynamics, multi-project dynamics (e.g., multiple projects sharing common resources), and organization-wide dynamics (e.g., impacts of organization-wide policies for software reuse). Through modeling and simulation, these models serve as experimentation laboratories to study software project management phenomena and gain a better understanding of the dynamically complex interactions and trade-offs that characterize software project management.

Professor Abdel-Hamid is also working on the development of intelligent tutoring interfaces to the system dynamics models of software project management in order to use them as learning laboratories for software project managers. (This is analogous to the use of flight simulators in training pilots.)

Sengupta, K. and Abdel-Hamid, T.K.   An Investigation of Alternat
Strategies in Dynamic Decision Making.   Management Science (Apr
411-428.

Abdel-Hamid, T.K.   Adapting, Correcting, and Perfecting Softwar
maintenance Metaphor.   Computer (March 1993): 20-29.

Abdel-Hamid, T.K. and Madnick, S.E.   Software Project Dynamics:
Integrated Approach. New York: Prentice-Hall, 1991.

Software Reliability

Since software process and product evolve over time, software reliability models should be designed to selectively use failure data to reflect this fact. To meet this need, a software reliability model with optimal selection of failure data was developed.

Professor Schneidewind has developed a software reliability model that is used by LORAL Space Information Systems and NASA at the Johnson Space Center in Houston to assist in making reliability predictions of the Space Shuttle flight software. The model predicts time to next failure and remaining failures to help assure the flight worthiness of the Shuttle software. These predictions, along with many other quality assurance techniques, provide confidence prior to launch that there will be no critical (i.e., loss of life or mission) software failures during a Shuttle mission.

This model is one of only four models recommended by the American National Standards Institute/American Institute of Aeronautics and Astronautics Recommended Practice for Software Reliability. The Schneidewind model is also one of the models included in the Statistical Modeling and Estimation of Reliability Functions for Software (SMERFS) tool, developed by the Naval Surface Warfare Center, which has been acquired by hundreds of government, industrial, and academic organizations. For the development of this model and other contributions to software measurement, Dr._ Schneidewind was elected a Fellow of the Institute of Electrical and Electronics Engineers in 1992.

Publications:

Schneidewind, Norman F.   Validating Metrics for Controlling and
Quality of Space Shuttle Flight Software , IEEE Computer Vol. 27
(August, 1994): 50-57.

Schneidewind, Norman F.   Software Reliability Model with Optima

of Failure Data.   IEEE Transactions on Software Engineering, Vo
(November 1993): 1095-1104.

Schneidewind, Norman F. and T.W. Keller.   Application of Reliab
to the Space Shuttle.   IEEE Software, Vol. 9, No. 4, (July 1992)

Schneidewind, Norman F.   Methodology for Validating Software Me
 IEEE Transactions on Software Engineering, Vol. 18, No. 5, (May
422.

Software Metrics

The measurement of the productivity of information systems is a critical element in the legitimation, funding and development of information technology. The attraction of convenient surrogate metrics for productivity raises the possibility that the management and support structure for information technology, although not the technology itself, may drift into irrelevance. Developing metrics of system productivity that are validated with behavioral anchors or employ non-obtrusive instrumentation is essential to gaining support for information technology from increasingly skeptical decision makers in the top levels of management.

Professor William Haga s research efforts have included the measurement of the effectiveness of the SACONS and APADE contract-generation systems through the collection of field data on inputs and outputs in a pre- experimental design. He has assisted the Office of the Director of Defense Information in developing guidance for DOD managers who undertake business process re-engineering. To this end, he directed the development of the REAP database. He also proposed an automation of the budget forecasting and planning module of the Navy Bureau of Medicine's executive information system.

His emerging interest is in examining the impact of information technology upon work relationships in organizations and upon society and culture at large. ·

Publications:

Haga, W J and M Zviran.   Information Systems Effectiveness: R
Designs for Causal Inference.   Journal of Information Systems,
1994): 141-166.

Euske, K J and W J Haga.   Process for Improving Processes: Elem
Issues.   Consortium for Advanced Manufacturing International-C
Management Systems Program, San Diego>, (March 1993).

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Haga, W J and M Zviran.   Key Issues In IS Management: The U.S.
Perspective.   Defense Analysis, Vol. 9, No. 2 (August 1993): 19

Application Development

Application development is concerned with the translation of information systems requirements into a working system that satisfies the requirements.

Professor Emery s recent research has focused on the problem of developing application software. The conventional software development process employing a multi-phased structured design process and writing custom programs in a procedural language has led to frequent budget and schedule overruns and systems that often do not meet the changing needs of users.

A variety of new approaches to application development appear to offer substantial potential for improving the process. Included are the use of application packages, templates, reusable objects and components, middleware products to integrate components, and 4th generation languages.

Professors Emery and Frew are studying various approaches to integrating and interconnecting applications to increase the efficiency and effectiveness of enterprise-wide information management support. The intent is to develop real applications for real use at NPS, because the school is viewed as a microcosm of DoN/DoD s information environment. A wide spectrum of technical approaches is being used, including the implementation of Commercial-Off-The-Shelf (COTS) products for client/server use of work-group, work-flow products for document management and fourth generation (4GL) application development tools. The strategy is to use DoD processes and standards in building interoperable applications in order to develop a model for wider use within DoD/DoN.

Publications:

Emery, James C. and Dani Zweig.   The Use of Ada for the Implem
Automated Information Systems within the Department of Defense.
Postgraduate School (December 1993): 33.

Emery, James C.   The Strategic Implications of a Productive Sof
Development Process.   Proceedings of the Workshop on Informatio
Technologies and Systems, M.I.T. (December 1991): 15.

Emery, James C.   ADA and Management Information Systems: Policy
Concerning Programming Language Options for the Department of De

Naval Postgraduate School, Monterey, CA, (June 1991):102.

Emery, James C. Organizational Planning and Control Systems: Th
Technology, Macmillan, (1969).

NETWORKS AND COMMUNICATIONS

Distributed Systems and Computer Networks

A paradigm has been developed for the system and software design of distributed systems, with application to large scale computer networks consisting of local area networks interconnected by a wide area network.

Professor Schneidewind has developed a paradigm for the system and software design of distributed systems with application to the Navy s Stock Point Logistics Integrated Communications Environment (SPLICE), which is a distributed computer network for providing high speed logistics transaction processing to support the Navy s world-wide material requirements. The system consists of local computer networks and an interconnecting wide area network, the Defense Data Network.

A number of design principles are offered with particular reference to how they can be applied to the design of distributed systems. The major contribution to the field of distributed systems is an explanation of how to make design decisions about distributed systems in a way that will enhance maintainability and understandability of the software and, at the same time, result in good system performance. An additional objective is to recognize the implications for software quality of various decisions which must be made in the process of specifying a distributed system.

Publications:

Schneidewind, Norman F.   Interconnecting Local Networks to Long
Networks.   IEEE Computer, Vol. 16, No. 9, (September 1983): 15-

Schneidewind, Norman F.   Distributed System Software Design Par
Application to Computer Networks.   IEEE Transactions on Softwar
Engineering, Vol. 15, No. 4, (April 1989): 402-412.

Telecommunication Systems

Professor Sridhar is interested in the use of quantitative and qualitative tools for modeling, analysis, design and management of telecommunication systems. Sridhar has developed algorithms for optimally balancing a given workload among processors with preassigned loads, in a distributed computing system. The processors may either have equal or unequal processing rates. The analysis considers the case where perfect load balancing is possible, as well as the case where only approximate load balancing is possible.

His current research focuses on the economic aspects of configuring cellular networks. A model has been developed to determine the system configuration which will maximize the annual expected net revenues. The study includes an analysis of the impact of changes in design parameters on system configuration, the cost of competition, and its implications for the regulatory agency.

Publications:

Gavish, B., and S. Sridhar. O(n) Algorithms for Load Balancing Computing Systems. Computers and Operations Research, Vol. 21(3), (1991): 239-248.

Gavish, B., and S. Sridhar, Economic Aspects of Configuring Ce Networks, Wireless Networks, Vol.1(1), (1995): 115-128.

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DECISION AND INFORMATION SYSTEMS

RESEARCH CENTER

The Decision and Information Systems Research Center (DISC) was established at the Naval Postgraduate School in 1995. Its research focus is on the design, implementation, and analysis of information systems directed at organizational computing and decision making. The Center currently has 12 associated faculty, representing backgrounds and research interests in decision sciences, software development, networking, and interoperability and integration of information technologies and modeling methodologies. DISC provides a common identity for related research projects as well as various support services. The Center runs an active seminar series drawing speakers from various universities, industry, DoD organizations and research laboratories.

DISC faculty research is sponsored by a broad range of funding agencies, including several in the Department of Defense. Current topics being researched by the Center's faculty include:

- The use of the internet for sharing decision-oriented information technologies
- Development of multimedia-capable intelligent-tutoring technologies
- Evolutionary computing
- Investigation of new paradigms for developing organizational computing software
- Development of guidelines for the migration to an integrated and interoperable client-server architecture

Further information about the Center is available via the World Wide Web (http://sm.nps.navy.mil/DISC/disc.html), via electronic mail (disc@sm.nps.navy.mil), or by calling the Professor Hemant Bhargava at (408) 656-2264.

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MULTIMEDIA RESEARCH LABORATORY

The objective of the effort is to provide a vehicle for conducting interdisciplinary research on instructional technology and in information systems that utilize evolving multimedia technologies. The facility has been in existence since 1992 and is used by faculty and students from the Information Systems, Aviation Safety, and Command & Control areas. The laboratory provides multimedia computing facilities for two platforms: MS-DOS/Windows based and UNIX based systems. Currently, we have a network of Sun workstations as well as high-end MS-DOS-based machines.

The faculty and students involved with the laboratory are pursuing research on a variety of topics, much of it in cooperation with different units of the Navy and other services. Principal areas of research include:

- Development of a prototype computer-based system for training on night vision goggles
- Application of Multimedia for Capturing Design Rationale
- Design and Implementation of an Expert Advisor for Maintenance of the Mark-92 Fire Control System
- Development of Interactive Education Media

For further information, contact Professor Sengupta, Director of the Multimedia Research Laboratory at Phone: (408) 656-3212 or via E-mail: kishore@nps.navy.mil

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SOFTWARE METRICS RESEARCH CENTER

Increasingly, DoD is requiring the use of metrics in software development contracts. Although there have been significant achievements in this area, there exists gaps in theory and practice. Among these are validation methodologies, process methodologies, databases, metrics tools, and cost analyses. The Software Metrics Research Center was established in response to DoD needs to address these issues. Here students and faculty tackle such issues as integration of metrics methodology into the software life-cycle process, development of metrics tools, and general metrics research. Current research projects include:

- Space Shuttle Software Reliability and Metrics
- A Software Reliability Model with Optimal Selection of Failure Data

For further information, contact Professor Schneidewind, Director of the Software Metrics Research Center at Phone: (408) 656-2719 or via E-mail: Schneidewind@nps.navy.mil

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Recent Research Sponsors

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- Army Artificial Intelligence Center
- Army Strategic Logistics Agency (SLA)
- Canada Council for Research in Social Sciences
- Chief of Staff, Headquarters, Department of the Army
- Coast Guard
- Commander Military Sealift Command (MSC)
- Commander Naval Aviation, Pacific
- Credit Suisse, Information Systems Center of the Canton of Vaud, Switzerland
- Defense Information Systems Agency (DISA)
- Defense Manpower Data Center (DMDC)
- Hong Kong Competitive Earmarked Research Grant
- Hong Kong University of Science and Technology
- Marine Corp, Tactical Systems Support Activity (MCTSSA)
- Naval Air Systems Command (NAVAIR)
- Naval Center for Cost Analysis
- Naval Sea Systems Command (NAVSEA)
- Naval Surface Warfare Center (NSWC)-Dahlgren Division
- Naval Surface Warfare Center -Port Hueneme Division
- Office of Naval Research (ONR)
- Pacific Bell
- Swiss National Foundation for Scientific Research

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Recent Publications

1995 Publications

IT95.1 Gavish, B. and S. Sridhar.   Economic Aspects of Configu
Networks.   WIRELESS NETWORKS   Vol. 1, No. 1, (Jan.1995).

IT95.2 Sengupta, K.   Cognitive Feedback in Environments Charac
Irrelevant Information.   OMEGA: International Journal of Manage
Vol. 23 (1995): 411- 428.

IT95.3 Ramesh, B.   An Intelligent Assistant for Requirements V
embedded systems.   Journal of Systems Integration Vol. 5, No. 2

IT95.4 Ramesh, B. et al   Implementing Requirements Traceabili
the IEEE International Symposium on Requirements Engineering Yor
1995).

IT95.5 Kamel, M. N.   Identifying, Classifying, and Resolving
Distributed Heterogeneous Databases: A Case Study.   Journal of
Management   Vol. 6, No. 1, (Winter 1995): 20-32.

IT95.6 Binbasioglu, T. Bui, and Ma.   An Action-Resource Langua
Argumentation: The Case of Softwood Lumber Negotiation.   28th
International Conference in System Sciences   (January 1995).

1994 Publications

IT94.1   Ceruti, M. G. and M. N. Kamel.   Semantic Heterogeneity
Data Dictionary Integration for Command and Control Systems.
11th Annual Department of Defense Database Colloquium, Database
CA (August 1994): 65-88.

IT94.2 Ramesh, B. and K. Sengupta .   Managing Cognitive and Mi
Conflicts.   Concurrent Engineering Research and Applications V
236.

IT94.3 Sengupta, K., D. Te eni, N. Melone, M. Limayen, and S. W

of Work and the Design and Use of Group Support Systems.   Accou
Management, and Information Technology Vol. 4, No. 4, (1994): 2

IT94.4 Ramesh, B. and V. Dhar .   Representation and Maintenan
Knowledge for Large Scale Systems Development.   IEEE Expert, S
Knowledge Based Software Engineering (April 1994).

IT94.5 Schneidewind, Norman F. Validating Metrics for Control
the Quality of Space Shuttle Flight Software.   IEEE Computer V
(August, 1994): 50-57.

IT94.6 Bhargava, H.K., R. Krishnan, and A.B. Whinston.   On Int
and Collaborative Technologies.   Journal of Organizational Com
(1994).

IT94.7 Dolk, D.R. and K. J. Euske.   Model integration: Overcom
organization.   Advances in Management Accounting Vol. 3. M.J.
Poston (Eds),. JAI Press, Inc., (1994).

IT94.8 Gavish, B., J. Gerdes, and S. Sridhar.   CM3, Looking i
Fourth Dimensions of GDSS.   INTEGRATION, INFORMATION AND
COLLABORATION MODELS. Kluwer Academic Pub. (1994): 269-299.

IT94.9 Emery, J. C. Report of the Committee on Computing. Nav
School, Monterey, CA, (July 1994): 32.

IT94.10 Frew, Barry.   Training and Educating IS Professionals
Information Technology in Changing Organizations.   Proceedings,
Reinventing IS: Managing Information Technology in Changing Orga
1994).

IT94.11 Haga, W. J. and M. Zviran.   Information Systems Effect
Designs for Causal Inference.   Journal of Information Systems
141-166.

IT94.12 Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck.   The
Structures on Allocating Shared Staff Resources Among Interdepen
Projects: An Experimaental Investigation.   IEEE Transactions on
Management Vol. 41, No. 2, (May 1994):115-125.

IT94.13 Abdel-Hamid, T.K., K. Sengupta, and M. Hardebeck.   The
Reward Structures on Staff Allocations in a Multi-project Softwa
Environment.   IEEE Transactions on Engineering Management Vol.

IT94.14 Ramesh, B., and K Sengupta.   REMAP/MM: Multimedia in D
Support with Design Rationale.   Decision Support Systems (Nove

IT94.15 Ramesh, B., and K. Sengupta.   Managing Cognitive and M
Conflicts in Concurrent Engineering.   Concurrent Engineering Re
Applications Vol. 2, (1994): 223-236.

238

IT94.16 Bui, Tung and Mak.   An Empirical of Neural Networks in Making.   Proceedings of WITS Vancouver (December 1994).

IT94.17 Bui, Tung and Petrazzini.   Vietnam: Rapid Growth and C Telecommunications Journal (October 1994).

IT94.18 Bui,Tung and Mak.   Modeling Expert s Knowledge: The Ne Entry Problem.   IEEE Conference of Software Engineering, Austin 1994).

IT94.19 Bui, T. Evaluating Negotiation Support Systems: A Conc Hawaii International Conference in System Sciences Vol. III (Ja

1993 Publications

IT93.1   Abdel-Hamid, T., K Sengupta, and D. Ronan.   Software Proje Experimental Investigation of Judgment under Fallible Informatio Transactions on Software Engineering Vol. 19 (June 1993) 603-612

IT93.2 Sengupta, K. and D. Te eni.   Cognitive Feedback GDSS: and Convergence.   MIS Quarterly Vol. 17 (1993): 87-114, .

IT93.3 Sengupta, K. and Abdel-Hamid, T.   Alternative Conceptio Dynamic Environments: An Experimental Investigation.   Managem 39 (April 1993): 411-428.

IT93.7 Abdel-Hamid, T.K.   Adapting, Correcting, and Perfecting A maintenance Metaphor.   Computer (March 1993): 20-29.

IT93.8 Haga, W. J. and J. D. Harrigan.   Planning for natural d Experience.   Proceeding of Computer Security International 93, 1993): 19-22.

IT93.9   Haga, W. J. and M. Zviran.   Key Issues In IS Managemen Perspective.   Defense Analysis Vol. 9, No. 2 (August 1993):197

IT93.10 Zviran, M. and W. J. Haga.   Question And Answer Passwo Empirical Evaluation . The Computer Journal Vol. 35, No. 3 (19

IT93.11 Euske, K.J. and W. J. Haga.   Process For Improving Pro And Issues.   Consortium for Advanced Manufacturing Internationa Management Systems Programs, San Diego (March 1993).

IT93.12 Schneidewind, Norman F. Software Reliability Model wit Selection of Failure Data.   IEEE Transactions on Software Engin 11 (November 1993): 1095-1104.

239

IT93.13 Bhargava, H. K. and S.O. Kimbrough. Model Management:
Languages Approach. Decision Support Systems Vol. 10, No. 3 (1

IT93.14 Bhargava, H. K., Dimensional Analysis in Mathematical
A Simple Numerical Method. ORSA Journal on Computing Vol. 5,
33 39.

IT93.15 Bhargava, H. K, and R. Krishnan. Computer-aided Model
Decision Support Systems Vol. 9, No. 1 (1993): 91 111.

IT93.16 Buddenberg, Rex. Computer Networking and C3I Systems
Services. (1993). Available on ftp.nps.navy.mil in pub/sm/bud
~/text_wp and on http://vislab-www.nps.navy.mil/~budden.

IT93.17 Dolk, D.R. and Kottemann, J.E. Model integration and
Models. Decision Support Systems Vol. 9 (1993): 51-63.

IT93.18 Emery, James C. and Dani Zweig. The Use of Ada for t
of Automated Information Systems within the Department of Defens
Postgraduate School (December 1993): 33.

IT93.19 Kamel, N. N., T. Song, and M. N. Kamel, An Approach f
Integrated Environment for Molecular Biology Database, Journal
Parallel Databases Vol. 1, No. 3 (July 1993): 303-327.

IT93.20 Emery, James C. The Global Organization as the Norm.
Global Information Management Vol. 1, No. 3 (Summer 1993):3-4,

IT93.21 Ramesh, B. and M. Edwards . Issues in the Development
Requirements Traceability. In Proceedings of the IEEE Interna
Requirements Engineering, San Diego, CA. (January 1993).

IT93.22 Bui, T. and Strand. A Neural Net Model to Represent
Heuristics. 25th Hawaii International Conference in System Sci
(January 1993).

IT93.23 Bui, Tung. A Neural-Network Based Behavioral Theory o
Commanders, Neural Network Research for Military Applications.
Ed.), Book Chapter, NPRDC, San Diego, (1993).

IT93.24 Bui, T, Designing Multiple Criteria Negotiation Suppo
Framework and Issues. Book Chapter, Multiple Criteria Decisio
and enrich the Domains of Thinking and Applications (Tzeng et al
Verlag. (December 1993).

1992 Publications

IT92.1 Schneidewind, N. F. and T.W. Keller. Application of Reli
   the Space Shuttle. IEEE Software Vol. 9, No. 4 (July 1992): 2

IT92.2   Ramesh, B. and V. Dhar. Supporting Systems Developmen
Deliberations during Requirements Engineering. IEEE Transacti
Engineering (June 1992).

IT92.3 Bui, T. and Sivasankaran. A Stochastic Model of Organ
Belgium Journal of Operations Research, Statistics and Computer
No. 3-4 (1992).

IT92.4 Bhargava, H. K., R. Krishnan, and S. Mukherjee. On th
Algebraic and Data Modeling Languages. Annals of Operations R
(1992): 69-95.

IT92.5 Emery, James C., Tung X. Bui and Cheryl D. Blake. Pro
Application Generators: Lessons Learned from the Naval Aviation
Management Information System Case. Naval Postgraduate School
56.

IT92.6 Dolk, D.R., D.G. Castillo, D.J Kridel. GOST: An active
costing and planning NASA space programs. Journal of Managemen
Systems Vol. 6, No. 1 (January 1992).

IT92.7 Emery, James C. Downsizing the Enterprise. SIM Netw
(Jan-Feb 1992).

IT92.8 M. N. Kamel and N. N. Kamel. The Federated Database Ma
System: Requirements, Issues and Solutions. Journal of Compute
Vol. 15, No. 4 (May 1992): 270-278.

IT94.9 Schneidewind, Norman F. Methodology for Validating So
IEEE Transactions on Software Engineerin, Vol. 18, No. 5 (May 19

1991 Publications

IT91.1 Gavish, B., and S. Sridhar. O(n) Algorithms for Load
Distributed Computing Systems." Computers and Operations Resea
Vol. 21, No. 3 (1991): 239-248.

IT91.2 Emery, James C. The Strategic Implications of a Produc
Development Process. Proceedings of the Workshop on Informatio
and Systems, M.I.T. (December 1991): 15.

IT91.3   Emery, James C. ADA and Management Information System
Issues Concerning Programming Language Options for the Departmen
Naval Postgraduate School, Monterey, CA, (June 1991): 102.

241

IT91.4 H.K. Bhargava, S.O. Kimbrough, and R. Krishnan. Unique
Violations, a Problem for Model Integration or You Say Tomato, I
ORSA Journal on Computing Vol. 3, No. 2 (Spring 1991): 107-120.

IT91.5 Dolk, D.R. and D.J. Kridel. An Active Modeling System
Analysis. Decision Support Systems, Vol. 7 (1991).

IT91.6 Abdel-Hamid, T.K. and S.E. Madnick. Software Project
Integrated Approach. New York: Prentice-Hall, (1991).

IT91.7 Haga, W. J. and M. Zviran. The Practice of Password Us
Empirical Evidence. Proceedings of the Seventh Inter-national
Information Security, Brighton (May 1991).

1990 Publications

IT90.1 Haga, W. J. and M. Zviran. Cognitive Passwords: Key to Ea
Control. Computers and Security Vol. 9 (December 1990): 723-

IT90.2 Emery, James C. The Strategic Role of Information Sys
Academy of Management Information, Japan, Vol. 1, No. 1 (Nov 199

IT90.3 Haga, W. J. and M. Zviran. Comparison of Password Tec
Proceedings of Computer Security International 90, London, (Octo

IT90.4 Zviran, M. and W. J. Haga. User Authentication by Cogn
Proceedings of the Fifth Jerusalem Conference on Information Tec
1990).

IT90.5 Henderson, D. R. and W. J. Haga. How to Account for In
Taking Present Values. Naval Postgraduate School Technical Rep
Management Department, NPS-54-90-020, (September 1990).

IT90.6 Haga, W. J. and M. Zviran. Password Security: An Explo
Naval Postgraduate School Technical Report, Systems Management D
NPS-54-90-011, (May 1990).

IT90.7 Zviran, M. and W. J. Haga. A Comparison of Password Te
Multilevel Authentication Mechanisms. Naval Postgraduate Schoo
Systems Management Department, NPS-54-90-014.

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REFERENCES

1. Altman, Rick. Mastering CORELDRAW 5. Special ed. San Francisco: SYBEX Inc., 1994.

2. Corel Corporation. CorelDRAW User's Manual Version 5.0, Vol 2. Canada: Corel Corporation, 1994.

3. Tittel, Ed, and Steve James. HTML for Dummies. Foster City, C. A.: IDG Books Worldwide, Inc., 1995.

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